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THESIS

AN ANALYSIS OF DEPOT LEVEL MAINTENANCE FOR THE H-60 HELICOPTER UNDER AN INTEGRATED MAINTENANCE CONCEPT

by

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September, 1997

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This thesis examines the depot maintenance processes of naval H-60 helicopters. Budget and political climate issues are discussed. Aircraft Service Period Adjustment (ASPA) deferral rates, Standard Depot Level Maintenance (SDLM) turnaround time, depot maintenance direct labor and material costs, and projected backlog using depot requirements and funding are examined. Data analysis indicates a need for significant process improvements or radical changes to depot processes. The Integrated Maintenance Concept (IMC) will consolidate organizational and depot level maintenance at fleet locations. IMC offers several advantages over traditional depot maintenance methods. Using regression analysis, the direct costs of SDLMs conducted at the Pensacola Naval Aviation Depot from 1987 to 1995 were used to estimate direct costs of depot maintenance based on: aircraft age, the projected level of depot maintenance, and employment (operational versus training). Within the scope of this research, a weak correlation existed between the direct labor costs and aircraft age and employment as explanatory variables; direct material costs showed a higher correlation; for total direct costs, these two variables explained 34.4 percent of the variation. Incorporating additional explanatory variables, such as flight hours prior to SDLM, may improve the model. Finally, recommendations are made to facilitate the transition to Integrated Maintenance, emphasizing data collection requirements and data analysis techniques to better estimate maintenance and funding requirements.

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ABSTRACT

This thesis examines the depot maintenance processes of naval H-60 helicopters. Budget and political climate issues are discussed. Aircraft Service Period Adjustment (ASPA) deferral rates, Standard Depot Level Maintenance (SDLM) turnaround time, depot maintenance direct labor and material costs, and projected backlog using depot requirements and funding are examined. Data analysis indicates a need for significant process improvements or radical changes to depot processes. The Integrated Maintenance Concept (IMC) will consolidate organizational and depot level maintenance at fleet locations. IMC offers several advantages over traditional depot maintenance methods. Using regression analysis, the direct costs of SDLMs conducted at the Pensacola Naval Aviation Depot from 1987 to 1995 were used to estimate direct costs of depot maintenance based on: aircraft age, the projected level of depot maintenance, and employment (operational versus training). Within the scope of this research, a weak correlation existed between the direct labor costs and aircraft age and employment as explanatory variables; direct material costs showed a higher correlation; for total direct costs, these two variables explained 34.4 percent of the variation. Incorporating additional explanatory variables, such as flight hours prior to SDLM, may improve the model. Finally, recommendations are made to facilitate the transition to Integrated Maintenance, emphasizing data collection requirements and data analysis techniques to better estimate maintenance and funding requirements.

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I. INTRODUCTION AND BACKGROUND

A. GENERAL

In recent years, aircraft depot maintenance has become a significant budget issue for the Department of Defense (DoD). Factors such as decreasing numbers of new procurements, Base Realignment and Closure (BRAC), and a decreasing overall defense budget are driving efforts to make current processes more efficient and to implement radical changes in conducting depot maintenance. In addition to reducing costs, these efforts are intended to ensure high quality in depot maintenance and maintain a solid depot maintenance capability while continuing to meet operational commitments.

As an alternative to the current Standard Depot Level Maintenance (SDLM) process, the Navy is proposing a program termed Integrated Maintenance Concept (IMC) for its fleet of H-60 SeaHawk helicopters. Depot level maintenance, traditionally performed at government or "organic" industrial establishments, is designed to ensure the continual flying integrity of airframes and flight systems through engineering assistance and the performance of maintenance that is beyond the capability of organizational or intermediate levels. Depot capabilities include the manufacture, major overhaul, modification, testing, inspecting, sampling and reclamation of aircraft and aviation components. IMC is not intended to fully replace SDLM as it is necessary to maintain certain capabilities inherent to depot locations. This thesis investigates the current overhaul process, analyzes the proposed IMC process, recommends cost-estimating and capturing models, and offers conclusions for the H-60 Program Office (PMA-299) to consider. Although the IMC program covers all SeaHawks, the data analysis and conclusions presented in this thesis are based primarily on the oldest SeaHawk model, the SH-60B.

B. BACKGROUND

1. The H-60 SeaHawk

The Sikorsky H-60 SeaHawk is the newest, most advanced aircraft in the Navy's Helicopter fleet. In regard to the Navy, "H-60" refers to three current models: the SH-60B, SH-60F, and HH-60H. Descriptions of each platform and their missions are presented in Appendix B. The SH-60B is depicted in Figure 1.

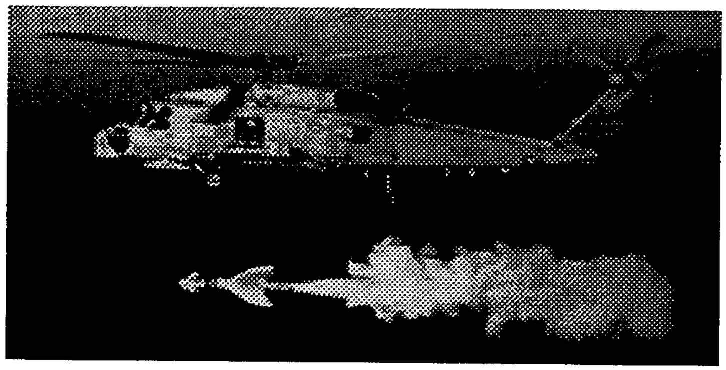

Figure 1 - SH-60B SeaHawk

2. The Helo Master Plan

Due to growing concerns about the future of naval rotary wing aviation (e.g. - aging airframes, budget uncertainties and constraints, changing threats, insufficient planning of modernization programs, etc.), the Navy commissioned the Center for Naval Analysis (CNA) to study the Helo Force Structure in 1994. This study not only assessed current helicopter assets, but validated the force structure over the past 30 years. It served as a catalyst for Battle Group Commander inputs to issues regarding rotary wing aviation to the 2020 timeframe.

The CNA study produced what is referred to as the Helo Master Plan. An ongoing document, the goals of the Helo Master Plan are to: expand warfighting capability, modernize the force, and consolidate force structure. Specific objectives are to reduce the number of different Type/Model/Series of aircraft in the inventory, reduce costs and infrastructure, investigate cross community efficiencies, construct a consolidated force structure to support carrier, amphibious, and support ship operations, and support the aviation commitments to a larger helicopter compatible Surface Combatant Inventory.[1] The Helo Master Plan calls for converting all SH-60B and SH-60F aircraft to SH-60R variants and replacing CH-46D aircraft with CH-60 helicopters. Appendix C is a breakdown of the most recent plan for these transitions.

C. PURPOSE OF RESEARCH

The purpose of this thesis is to examine depot maintenance issues, analyze trends in the current Aircraft Service Period Adjustment (ASPA) and SDLM processes, and to analyze the initial proposal for shifting to the Integrated Maintenance Concept.

D. SCOPE OF RESEARCH

The Integrated Maintenance Concept encompasses Organizational, Intermediate, and Depot maintenance of naval H-60 helicopters. Combining these maintenance levels into an integrated process is a radical shift which will take time to complete. This thesis concentrates on the initial aspects of IMC, bringing Depot Level Maintenance closer to organizational units.

This thesis supports the efforts of the H-60 Multi-Mission Helicopter In-Service Support Team (MMHISST) located at MCAS Cherry Point, NC. As the Cognizant Field Activity (CFA) for naval H-60's, the MMHISST has been tasked with developing and implementing the Integrated Maintenance Concept. The financial goals of the MMHISST are to identify cost elements and develop a method for capturing total costs for each transition phase, leading to a smooth and accurate entry into full IMC. A direct cost-

1 Although the number of ships has decreased in recent years, the number of landing systems and hangar facilities on helicopter capable ships has increased, creating pressure on HSL squadrons to deploy more aircraft.

benefit analysis of the current ASPA/SDLM process and the Integrated Maintenance Concept is beyond the scope of this thesis.

The lack of available raw data limited the scope of this thesis. More detailed data about an aircraft's history (flight hours, number of deployments, maintenance man-hours per flight hour, etc.) were not readily available. Detailed cost and man-hour data from the Corpus Christi Army Depot (CCAD) were not available, so the primary data for SDLM direct cost analysis is from SDLMs conducted at the Pensacola Naval Aviation Depot (NADEP) up to FY 1995. Table 1 summarizes the data sources utilized for this research.

Table 1 - Data Sources

Data	Source	Comments
Production Productivity Reports	Naval Air Systems Command Cost Analysis Department (NAVAIR 4.2)	Detailed SDLM data from NADEP Pensacola (FY 87-95) (see note)
Production Status Reports	Navy Liaison Office, Corpus Christi Army Depot (CCAD)	SDLM Induction dates and completion dates, by BuNo. (FY 93-97) (see note)
Delivery dates of new production aircraft	DPRO Owego, NY	By BuNo and Lot Number (see note)
SDLM Cost and Turn-Around Time	Naval Air Systems Command Industrial Capabilities Department (NAVAIR 6.0D1, formerly NADOC)	NADEP Pensacola, CCAD and Sikorsky (averages and summary data only) planned (to FY 2004) and actual (FY 92 to present)
IMC Program Brief	Multi-Mission Helicopter In-Service Support Team (MMHISST), MCAS Cherry Point, NC	
Inflation Cost Indices	Naval Center for Cost Analysis (NCCA)	FY 97 indices (O&MN, less fuel) downloaded from WWW site
ASPA Data Base	MMHISST	Appendix F.

Note: Relevant fields presented in Appendix D.

E. METHOD OF RESEARCH

The research for this thesis included the following steps:

- (1) Literature Review: A review of reports on ASPA/SDLM issues from other aircraft was conducted. Various cost estimation techniques were examined. This review assisted in identifying relevant issues in depot level maintenance (common to many aircraft) and in developing an approach to analyzing the available data.

- (2) Interviews and Meetings: Program status and planning meetings were attended to ascertain the organization, objectives, and progress of the IMC program. Meeting attendees included Program Office, Fleet, Cognizant Field Activity (CFA), and Depot personnel familiar with the current SDLM process and its problems. This also served to make points of contact for data acquisition.

- (3) Data Acquisition and Analysis: Historical SDLM cost and schedule data were obtained and analyzed to determine trends and forecast future costs under the current system. Projected budget data were obtained to estimate the resources available for H-60 SDLM to FY 2004. SDLM Specification data was obtained from the CFA to assist in developing a model to capture costs for IMC processes.

Linear and multiple regression models were used to examine material and direct labor costs for SDLMs conducted at NADEP Pensacola. Explanatory variables for costs are aircraft age, lot numbers, coast, etc. The Work Standard (SDLM specification) was introduced as an explanatory variable to determine how actual costs for labor and material are affected by the amount of work planned. Given a planned scope of work, this would theoretically serve to develop a cost-estimating model for aircraft depot level maintenance.

F. THESIS ORGANIZATION

Chapter II discusses the overall depot maintenance environment and specific issues related to the depot level maintenance program for the H-60.

Chapter III analyzes data and trends from SDLMs conducted at NADEP Pensacola, CCAD, and Sikorsky.

Chapter IV describes the Integrated Maintenance Program proposed by the MMHISST.

Chapter V uses linear and multiple regression of data from Production Productivity Reports[2] (SDLMs conducted at NADEP Pensacola) to estimate the direct labor and material costs associated with depot level maintenance.

Chapter VI discusses the necessary elements for estimating and capturing costs associated with the Integrated Maintenance Concept.

Chapter VII summarizes the overall conclusions about Standard Depot Level Maintenance and the Integrated Maintenance Concept. It presents recommendations for both the program and future research.

A list of acronyms used in this thesis is contained in Appendix A.

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[2] Alternately termed "Production Performance Reports."

II. DISCUSSION OF DEPOT MAINTENANCE

This chapter describes issues related to depot maintenance. OPNAVINST 4790.2F describes the overall aircraft maintenance program in the U. S. Navy, the Naval Aviation Maintenance Program (NAMP). The NAMP is summarized in Appendix G.

A. THE DEPOT MAINTENANCE ENVIRONMENT

Many changes are occurring in depot maintenance activities. Since the end of the Cold War, reductions in operations, end strength and budget have reduced work levels at depots below ideal capacity. This resultant overcapacity has led to inefficiencies as overall costs have not been sufficiently reduced. Measures such as BRAC have not eliminated overcapacity and recent GAO reports indicate that realignment within organic depot facilities will not reduce costs as long as inefficiencies exist.[3] Consequently, there have been increasing demands for outsourcing and privatizing depot maintenance.

As discussed in an August 1996 report from the Defense Science Board, one contentious issue relates to statutory restrictions "such as 10 USC 2464 (which requires that DoD maintain an in-house 'core' logistics capabilities needed to support mission-essential DoD systems) and 10 USC 2466 (which essentially defines 'core' as 60 percent of depot-level maintenance workload)."[4] This report strongly recommended that the "DoD base source of repair decisions solely on the capability and reliability of the service provider," finding that "arbitrary restrictions such as the 60/40 requirement...result in an inefficient allocation of DoD maintenance resources."

3 Kocks, Kathleen, *The Next Moves For Depot Maintenance*, Rotor & Wing, April, 1997, p. 32.

4 Defense Science Board, Office of the Under Secy. of Defense (A&T), *Report of the Defense Science Board Task Force on Outsourcing and Privatization*, August, 1996.

Such conclusions and recommendations have resulted in potential legislative changes. The following is contained in the Senate Armed Services Committee report for the National Defense Authorization Act For Fiscal Year 1998:

> The committee is determined to ensure that excess capacity is reduced, the integrity of the BRAC process is preserved, and the Department of Defense (DoD) operates as efficiently as possible. Therefore, the committee recommends a series of provisions to improve the efficiency and effective management of DoD maintenance depots.
>
> Section 311, Definition of Depot-Level Maintenance and Repair, would codify the definition of depot-level maintenance and repair and essentially restates section 324 of the National Defense Authorization Act for Fiscal Year 1997 as passed by the Senate. This provision would simply codify the definition of depot maintenance contained in the DoD directive on the maintenance of military materiel (directive 4151.18), as including materiel maintenance or repair requiring the overhaul or rebuilding of parts, assemblies, or subassemblies and the testing and reclamation of equipment. This definition would apply to depot maintenance funded through interim contractor support or contractor logistics support which has not always been reported as depot maintenance in the past. This definition would not include ship modernization activities.
>
> Section 313, Core Logistics Functions of Department of Defense, would codify the current DoD definition of core logistics functions and require that the Department of Defense maintain sufficient capability (not actual repair) within the public depots to perform maintenance and repair of `mission essential' weapons systems and equipment required to support the Joint Chiefs of Staff contingency scenarios. This provision also requires the Department to calculate the required core maintenance levels annually and report to Congress the results of this determination, to include identification of mission essential systems and equipment, required core capabilities, actual number of direct labor hours required for each capability, and decision as to organic/private workload mix necessary to achieve the required core capability.

> Section 314, Percentage Limitation on Performance of Depot-Level Maintenance of Materiel, changes the 60/40 ratio to 50/50 as requested by the Secretary of Defense, effective October 1, 1998, and changes the basis for calculating what is public depot maintenance from work performed by Federal employees to work performed in Federal facilities. This provision would allow more flexible arrangements with the private sector for participating in the performance of maintenance workloads in Department of Defense (Government-owned, Government-operated) organic depot maintenance facilities.

Similarly, House Report 105-132, National Defense Authorization Act For Fiscal Year 1998 contains the following:

> SECTION 334--CORE LOGISTICS FUNCTIONS OF DEPARTMENT OF DEFENSE
>
> This section would amend section 2464 of title 10, United States Code, to clarify that it is essential for national defense that the Department of Defense (DoD) maintain a core logistics capability that is government-owned and government-operated. This section would require the Secretary of Defense to identify those logistics activities necessary to maintain a core logistics capability that would include the capability, facilities, and equipment to maintain and repair those weapons systems necessary to meet the requirements of the National Military Strategy. This section would also require the maintenance and repair of all new weapons systems purchased by the DoD, that are identified as requiring a core logistics capability, in government-owned and government-operated facilities within four years of initial operational capability.

Complicating the issue of public versus private logistics capability is the difficulty in cost accounting. The Defense Science Board report states, "government entities do not have in place the business systems and internal controls to properly measure and allocate indirect costs. Accordingly, government bids may not reflect the full cost of performing the competed function, thus undermining the basic premise of public/private competition." The report recommends a shift to Activity Based Cost Accounting to link cost information to meaningful outputs (specific products or services).

However, any move to reduce organic capabilities translates to potential job losses, so there are strong opponents to changing laws regarding depot maintenance and preserving organic depot maintenance.

B. THE H-60 DEPOT ENVIRONMENT

1. History

Up to the end FY 1995, naval H-60 SDLMs were conducted at NADEP Pensacola. The 1993 Base Realignment and Closure reduced the number of Naval Aviation Depots (NADEPs) from six to three. NADEP Pensacola was decommissioned in September 1995 and SDLM for naval H-60's was transferred to the Corpus Christi Army Depot (CCAD). CCAD is DoD's largest helicopter maintenance depot. It conducts repair, modification, overhaul and maintenance of the following Army rotary wing aircraft: AH-64, UH-60, UH-1[5], AH-1, OH-58, and CH-47. In addition to the SH-60, CCAD also conducts Standard Depot Level Maintenance for Navy UH-1N (Huey) and U. S. Marine Corps AH-1W (Super Cobra) aircraft. On-condition maintenance for UH-1N and HH-1H models is also performed for Air Force customers. As of June 1997, CCAD had completed SDLM on and delivered 8 SH-60B aircraft.

Since 1995, SDLMs have also been conducted by Sikorsky Aircraft at its Stratford, CT facility. Aircraft sent to Sikorsky also undergo modification to the Block I Upgrade SH-60B configuration. The process of populating the airframe with Block I avionics (conducted at the Lockheed-Martin facility in Owego, NY) adds approximately 90 days to the SDLM process. Sikorsky and Lockheed-Martin also conduct Block I

[5] Depot rework of all Army and National Guard UH-1 helicopters was recently outsourced to a private company (Rotor and Wing, August 1997, p. 10).

Upgrades to aircraft not requiring SDLM at modification hangars located at fleet sites (Mayport, FL and North Island, CA).

2. The Future

Although the recent changes and dynamic issues discussed above add complexity to decisions related to the conduct of depot maintenance for the H-60, potential changes (particularly changing the definition and ratio of "core" maintenance capability) will allow the H-60 Program Office to make more flexible arrangements with contractors performing depot level maintenance at Government locations (i.e.-Mayport and North Island). The location, efficiency, and lower costs of depot level work performed at the Block I Upgrade "mod-shops" support the introduction of concepts such as Integrated Maintenance. The extensive use of In-Service Repairs by government depot artisans offers a similar opportunity to conduct more extensive depot maintenance at fleet locations. However, many factors beyond the scope of this thesis will ultimately determine if, how, and when the Integrated Maintenance Concept is implemented. For example, although CCAD personnel have attended and participated in planning meetings, CCAD has not committed to participating in the Integrated Maintenance Concept or any other form of "SDLM at the seawall."[6] In summary, the combination of operational, economic, and political issues surrounding depot maintenance makes the future of Integrated Maintenance for the H-60 unknown.

6 Telephone interview with CFA, NADEP Cherry Point, August 1997.

III. ANALYSIS OF STANDARD DEPOT LEVEL MAINTENANCE

A. BACKGROUND

Overhaul and depot maintenance support for Navy aircraft is conducted through a process called Standard Depot Level Maintenance (SDLM). Induction into SDLM is on a recurring basis to correct structural and corrosion problems that cannot be corrected by organizational level maintenance. Planning and Evaluation (P&E) inspections on inducted aircraft determine the scope of depot maintenance, or "rework," to be completed.

Prior to 1984, aircraft were inducted for SDLM at the end of their Operating Service Period (OSP). The OSP is a fixed time interval with no regard to an aircraft's material condition. In 1984, just as the SH-60B was entering operational service, the Navy implemented the Aircraft Service Period Adjustment (ASPA). When an aircraft reaches its Period End Date (PED) (the year and month at the end its OSP), it receives an ASPA inspection by Depot field team inspectors to determine if it requires SDLM. Navy H-60's were given an initial PED of 36 months after being delivered new or completing SDLM. This period was increased to 48 months for the SH-60B in 1995. If an aircraft passes the ASPA inspection, it remains in operational service and its PED is extended 12 months past the original PED; at that time, another ASPA is scheduled. If an aircraft fails ASPA, it is transferred to the Corpus Christi Army Depot (CCAD) or the Sikorsky Aircraft facility at Stratford, CT, for induction into SDLM.

"The PED adjustment changes the basis for SDLM induction from the roughly constant 'on-time' basis to 'on-condition,' meaning that aircraft are inducted for SDLM only when their material condition warrants. Over 90 percent of Navy aircraft fall under the program. ASPA was intended to reduce the number of SDLM inductions by leaving aircraft in good condition out in the fleet."[7] The AV-8B and E-6A aircraft are notable exceptions to the ASPA program as they undergo Phase Depot Maintenance (PDM).

Depot maintenance support is also performed through In-Service Repairs (ISR). Depot personnel travel to fleet locations to effect aircraft repairs that are beyond the capability of O and I level maintenance and require less than 250 repair hours.[8] Also, In-Service Repairs are used extensively to correct major and critical discrepancies discovered during ASPA inspections (for aircraft that meet passing criteria and do not require SDLM). The H-60 utilizes ISRs more than other programs.[9] The increasing requirements and costs associated with In-Service Repairs encourage the implementation of programs such as Integrated Maintenance.

B. ASPA TRENDS

The data set presented in Appendix F is a subset of a data base consisting of approximately 10,890 entries. The original data base has detailed entries for discrepancies discovered during ASPAs (type, location, description, etc.). The data base was scrutinized and adjusted line by line as there were many inconsistencies. For example, on different line numbers, some aircraft had the same PED for different ASPA numbers or, conversely, a different PED for the ASPA number listed. For aircraft that passed an ASPA inspection, the data were smoothed by assuming the PED was approximately one year past the date of the report. Additionally, it was apparent that some data were absent. Where aircraft were missing a report prior to or between two passed ASPAs, it was assumed that the missing ASPAs were passed (e.g. - if data was present for ASPAs 2 and 4, it was assumed that ASPA 3 was passed. SH-60B BuNo

7 Levy, Robert. *ASPA and Depot-Level Pipeline Growth*. Center for Naval Analyses Report, March 1991. p.1.

8 Ibid. p.10.

9 SH-60 Assistant Program Manager, Logistics (APML), IMC Status Meeting, NAS North Island, July 1997.

162116 showed an ASPA 6 in August 1994, but no prior entries. ASPAs one through five were assumed passed). Similarly, for aircraft where the only listing was a failed ASPA, it was assumed that prior ASPAs were passed.

The first "tour" of an aircraft is the time since being delivered new to when it enters its first SDLM. Table 2 presents ASPA deferral rates for all first tour H-60's (all models) since 1994.

Table 2 - ASPA Deferral Rates (1st tour)

ASPA Number	1	2	3	4	5	6	7	8
Number of Aircraft Deferred	166	156	134	98	65	22	4	1
Number of Aircraft Inspected	167	156	139	109	71	34	7	1
Deferral Rate (%)	99.4	100.0	96.4	89.9	91.6	64.7	57.1	100.0

The second "tour" of an aircraft begins after completing the first SDLM. Table 3 presents ASPA deferral rates for all second tour H-60's (all SH-60B's) since 1994.

Table 3 - ASPA Deferral Rates (2nd tour)

ASPA Number	1	2	3	4	5	6	7
Number of Aircraft Deferred	42	32	25	14	3	2	1
Number of Aircraft Inspected	39	28	24	10	3	1	1
Deferral Rate (%)	92.9	87.5	96.0	71.4	100.0	50.0	100.0

These tables indicate that depot level maintenance on naval H-60's is generally being deferred well beyond the four year period end date. An aging fleet, combined with the unpredictable nature of the ASPA/SDLM process, indicates a high probability of aircraft soon failing to be available for fulfilling some operational requirements.[10] Because of variability in the ASPA process, accurate predictions of SDLM requirements

[10] A more complicated analysis, such as determining aircraft availability based on operational requirements, production rates, aircraft age, SDLM turn around time, etc. is beyond the scope of this thesis.

are difficult. This complicates other processes such as cost negotiation, determining overhead rates, and scheduling of parts required during the SDLM. These issues are the source of a general concern that there is a "bow-wave" of ASPA deferred aircraft that will eventually fail, creating SDLM demands that exceed the current throughput capacity of CCAD. This effect is becoming a reality as indicated by the average wait time of 27 days from arrival at CCAD to SDLM induction.[11]

C. IMPACT OF THE ASPA PROCESS

ASPA was introduced in 1984 to reduce costs in the short term. The ASPA/SDLM process conceptually has advantages in that aircraft are only inducted into SDLM when warranted by the material condition; unnecessary maintenance actions are presumably avoided.

However, the ASPA process introduces other factors that have complicated the SDLM process. The ASPA inspection depends on a complicated failure prediction model. This model cannot always accurately evaluate the material condition of the aircraft, which accounts for a wide variation in ASPA deferrals among fleet aircraft. Although pass/fail criteria are established (e.g. - a point system based on the number and type of major defects found), the ASPA inspection depends on the inspector's subjective recommendation on whether or not a one year service period adjustment would significantly affect safety, maintainability, or cost of rework. Because there is no way to predict ASPA pass/fail, SDLM induction rates (which dictate funding requests) cannot be properly planned. This problem has been exacerbated for the H-60 because the aircraft have not been failing at the expected rate, as indicated above. Anticipated SDLM requirements also drive funding. In 1994, it was estimated that SDLM inductions lagged

[11] Average of 30 aircraft. Does not include three aircraft that exceed 200 days wait time, which would increase the average wait time to 49 days.

predictions by approximately 40 percent, resulting in a 40 percent reduction of the H-60 O&MN SDLM budget request.[12]

ASPA inspections also burden Organizational Level Maintenance because the depot inspection teams require certain functions to prepare the aircraft for the inspection. Officially, these "ASPA preps" include positioning the aircraft and removing panels for access by the depot artisans. However, the impact of possibly failing an ASPA has resulted in Organizational Maintenance procedures to (unofficially) "groom" the aircraft for the inspectors. These procedures are generated locally, without the benefit of overall maintenance trends or Reliability Centered Maintenance (RCM) analysis. Although not specifically tracked, it is estimated that squadron maintenance personnel currently spend approximately 300 man-hours grooming an aircraft for an ASPA inspection.[13] This practice diverts man-hours that could be spent on other maintenance requirements and may hide (albeit unintentionally) physical indicators of an aircraft's deteriorating material condition (e.g. - cracks and corrosion). In the short term, this grooming results in an apparent material condition that may allow the aircraft to remain in operational service and delay the SDLM induction. In the long term, however, this contributes to the increase in ASPA deferrals leading to the "bow wave" discussed above.

D. SDLM TRENDS

The greatest concern about the current ASPA/SDLM process is the combined effect of a large number of ASPA deferrals and the rise in SDLM turnaround time. NADEP Pensacola Production Productivity Report (PPR) and CCAD Production Status Report (PSR) data since fiscal year 1987 were analyzed for cost and schedule trends. Appendix D contains raw PPR data, consolidated NADEP Pensacola data, and data

12 Somers, James, *H-60 SDLM Alternatives*, Report to NAVAIRSYSCOM H-60 APML, December 1994.

13 Discussion at IMC status meetings, 1997.

obtained from CCAD PSRs. Definitions of terms from NADEP PPRs are contained in Appendix E.

1. SDLM Induction Trends

While ASPA is intended to decrease the number of SDLMs by keeping aircraft in "good" material condition in the fleet, deferring depot maintenance has two effects. First, it makes planning for SDLM induction difficult. Table 4 presents the trend for induction to the first SDLM since 1991, indicative of the rise in ASPA deferrals.

Table 4 - SDLM Inductions, First Tour

FY	91	92	93	94	95	96	97	Average Since 1993
Number of Aircraft	11	12	9	5	7	3	3	27
Average aircraft age (Yr.) to Induction, 1st SDLM	5.86	5.79	6.82	7.48	8.94	8.17	7.91	7.76

Several conclusions can be drawn from Table 4. As indicated, the aircraft age at induction to the first SDLM has increased over the years. Since 1993, the average has been 7.76 years in service prior to SDLM.[14] Generally, although affected by the influence of O Level ASPA preparation and the subjectivity of ASPA inspectors, this indicates that aircraft are lasting longer than expected. Specifically, this likely indicates that (for aircraft in their first tour) the overall service interval for depot maintenance is higher than the current 48 months. It will be shown below, however, that the increased time in service has contributed to increased direct labor and material costs associated with the SDLM.

Seven SH-60B aircraft have been inducted for a second SDLM at NADEP Pensacola and CCAD. Table 5 indicates the trend for induction to a second SDLM.[15]

[14] Analysis of 27 data points since 10/01/93 yields a mean of 7.76 and a median of 7.77.

[15] BuNo 161553 was excluded as it was: the first production SH-60B, used exclusively at the FRS, and the first aircraft to enter SDLM (3.07 years in service). The high value for time to second SDLM (9.70 years) was considered misrepresentative.

Table 5 - SDLM Inductions, Second Tour

FY	93	94	95	96	97	Average
Number of Aircraft	1	1	1	2	1	6
Average aircraft age (Yr.) to Induction, 2nd SDLM	5.32	4.58	4.23	5.05	4.01	4.71

No specific trends are indicated in this limited sample size. The average age is 4.71 years in service from the completion of the first SDLM to induction for a second SDLM.[16] Comparing Table 4 to Table 5, it should be noted that, since 1993, the average age to induction for a <u>second</u> SDLMs is 3.05 years less than the average age prior to the <u>first</u> SDLM. This indicates the fact that the output of SDLM is "improved" but not "new" airframes. This effect, however, must be factored into the scheduling of future depot level maintenance. As the fleet ages, depot maintenance should be scheduled according to overall age, tour number, time in tour, and other variables such as flight hours.

2. Cost Trends From NADEP Pensacola

Because of the unpredictable nature of the ASPA pass/fail process, the level of work that is required during the current SDLM process cannot be adequately estimated. Using Production Productivity Reports (PPRs), SDLM costs from NADEP Pensacola were analyzed to identify trends and potential cost drivers. Using Excel pivot tables, cost averages for 50 "first-SDLM" aircraft were grouped by age, fiscal year inducted, and lot number.[17] Table 6 shows the summary of groupings.

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[16] Analysis of six data points yields a mean of 4.71 and a median of 4.41.

[17] Statistical and Overhead Costs were excluded from this analysis.

Table 6 - Grouping of PPR Data

Age	Number in Group	FY Inducted	Number in Group	Lot Number	Number in Group
2-3	1	87	4	I	9
3-4	8	88	2	II	17
4-5	7	89	2	III	12
5-6	14	90	6	IV	10
6-7	13	91	11	V	1
7-8	4	92	11	VI	1
8-9	3	93	10		
		94	4		
Total	50		50		50

Figure 2 depicts the average direct costs of NADEP Pensacola SDLMs based on age of aircraft prior to their first SDLM.

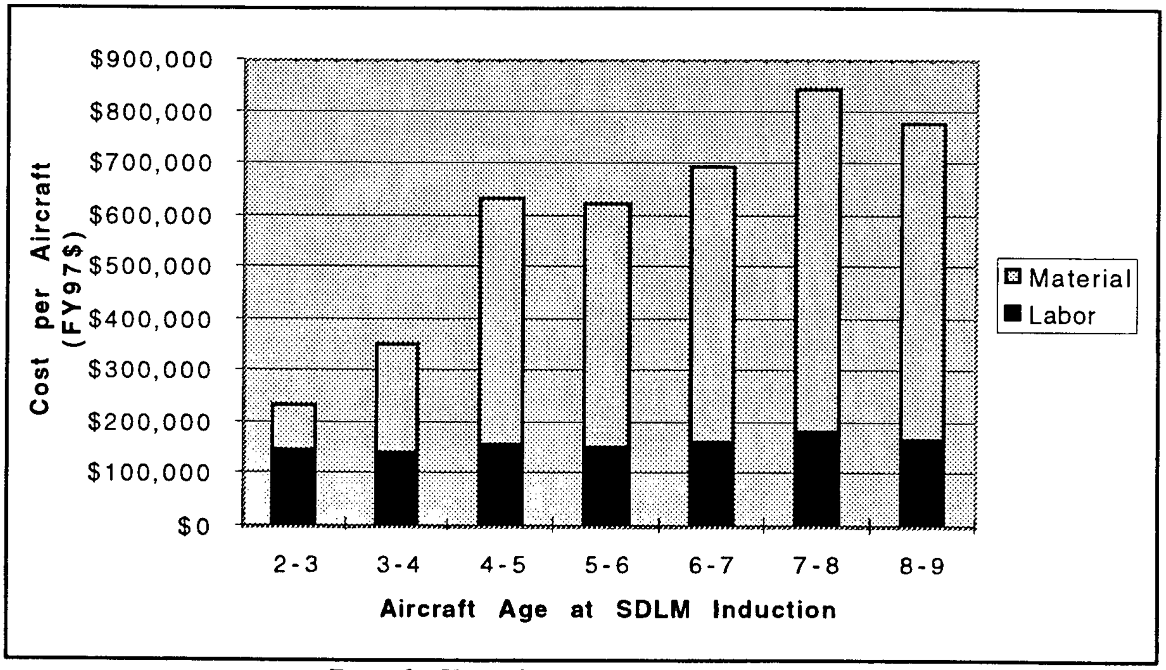

Figure 2 - SDLM Direct Costs by Aircraft Age

Figure 3 depicts the average direct costs of NADEP Pensacola SDLMs based on fiscal year inducted.

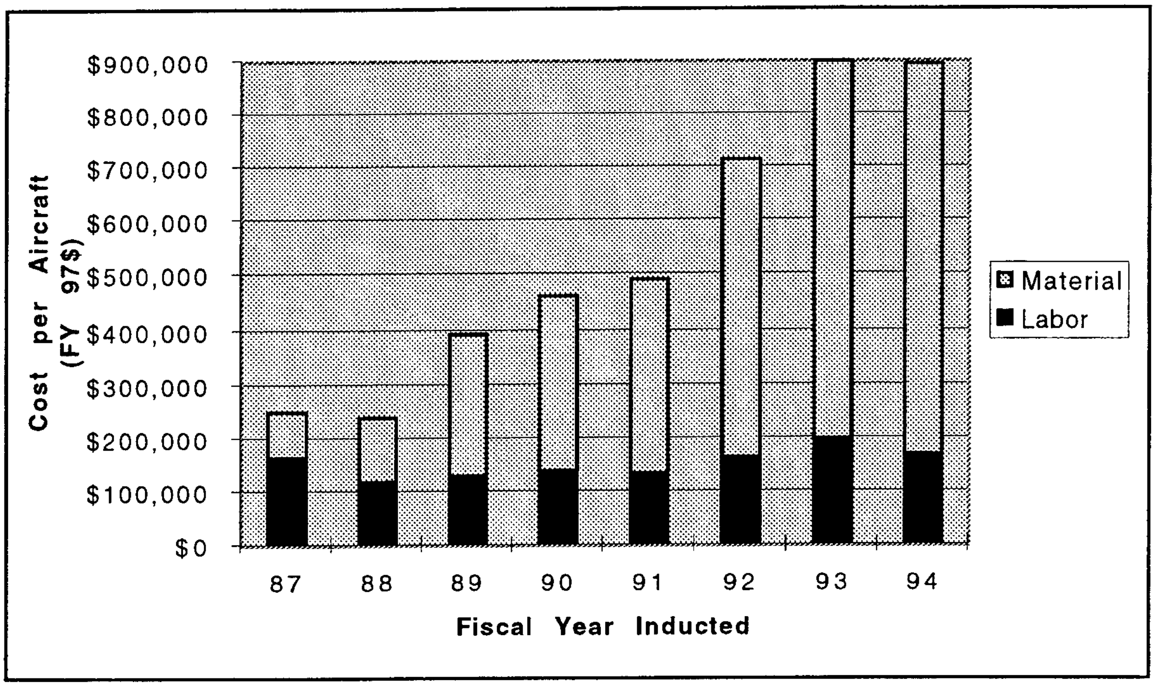

Figure 3 - SDLM Direct Costs by Fiscal Year

Figures 2 and 3 indicate that the material costs have increased considerably as the aircraft age increases (approximately 40 percent per year from 1987 to 1994). To a lesser degree, direct labor costs have also increased (approximately 7 percent per year from 1988 to 1994).[18] The effect of unpredictable induction ages contributes to scheduling problems (on average, higher actual turnaround times than estimated) and average higher actual costs.

It was desired to examine the effect of lot number on labor and material costs. SDLM cost per aircraft by lot number is presented in Figure 4.

[18] Fiscal year 1987 not included due to possible learning curve effects.

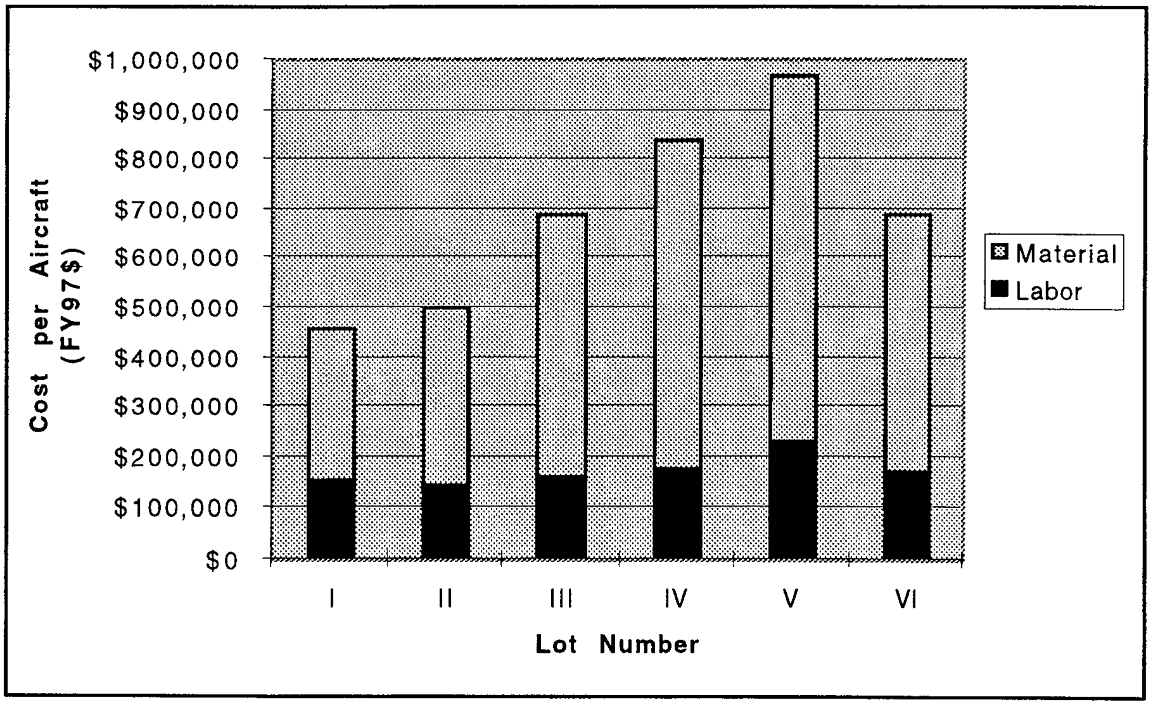

Figure 4 - SDLM Cost by Lot Number

While Figure 4 indicates an apparent rise in cost with lot number, it is important to note that lot numbers correspond to production years, so the increasing trend from the NADEP data is also attributable to increasing costs over time. Aircraft do vary, however, so depot maintenance costs may vary slightly with lot numbers.

3. Recent Cost Trends

In 1995, Sikorsky's actual SDLM cost per aircraft averaged 23.3 percent higher than the planned costs. In 1996, actual costs per aircraft were 51 percent higher than anticipated. For SDLMs conducted at CCAD, the Navy pays the negotiated price. Detailed cost information is not available. However, planned costs per aircraft for 1997 are approximately 34 percent higher than the cost negotiated with the contractor.[19]

[19]Relative percentages are used here; cost data obtained for Sikorsky and CCAD are considered "business sensitive."

Figure 5 shows the anticipated backlog of SDLM aircraft from FY 1997 to 2003. This figure is based on: planned Health of Naval Aviation[20] (HONA) funding for all H-60 SDLMs, assuming SDLM actual costs per aircraft average 25 percent greater than estimated (vice the higher percentages determined above), and estimated Current Year SDLM requirements (based on ASPA failure estimates provided by NADEP Cherry Point).[21]

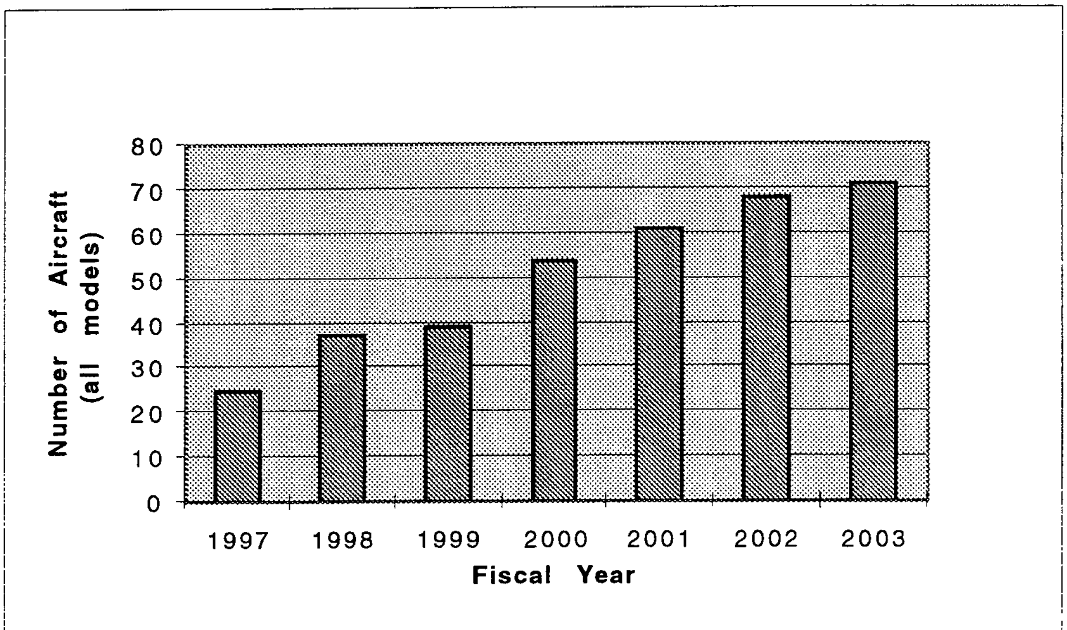

Figure 5 - Estimated SDLM Backlog

4. Recent Turnaround Time Trends

In 1995, Sikorsky's actual SDLM turnaround time (TAT) averaged 14 percent higher than planned. The primary concern in the fleet is the longer than expected TAT for

[20] HONA is a program designed to allocate funds for Naval Aviation in a structured and prioritized fashion to meet operational requirements while improving the overall "health" of naval air assets through modernization and improved maintenance programs.

[21] Each year's backlog was calculated using the following equation: Backlog = (SDLM Requirements + Carry-Over) - (Annual HONA Funded/estimated cost per aircraft).

SDLMs performed by CCAD. Since 1995, CCAD TAT has averaged 77 percent longer than planned.[22] Using PPR data from NADEP Pensacola and Production Status Report data from CCAD, average TAT was calculated for fiscal years 1987 to 1997. As depicted in Figure 6, the TAT at CCAD has averaged 58 percent higher than the TAT at NADEP Pensacola during the two years before the SDLM process moved to CCAD.

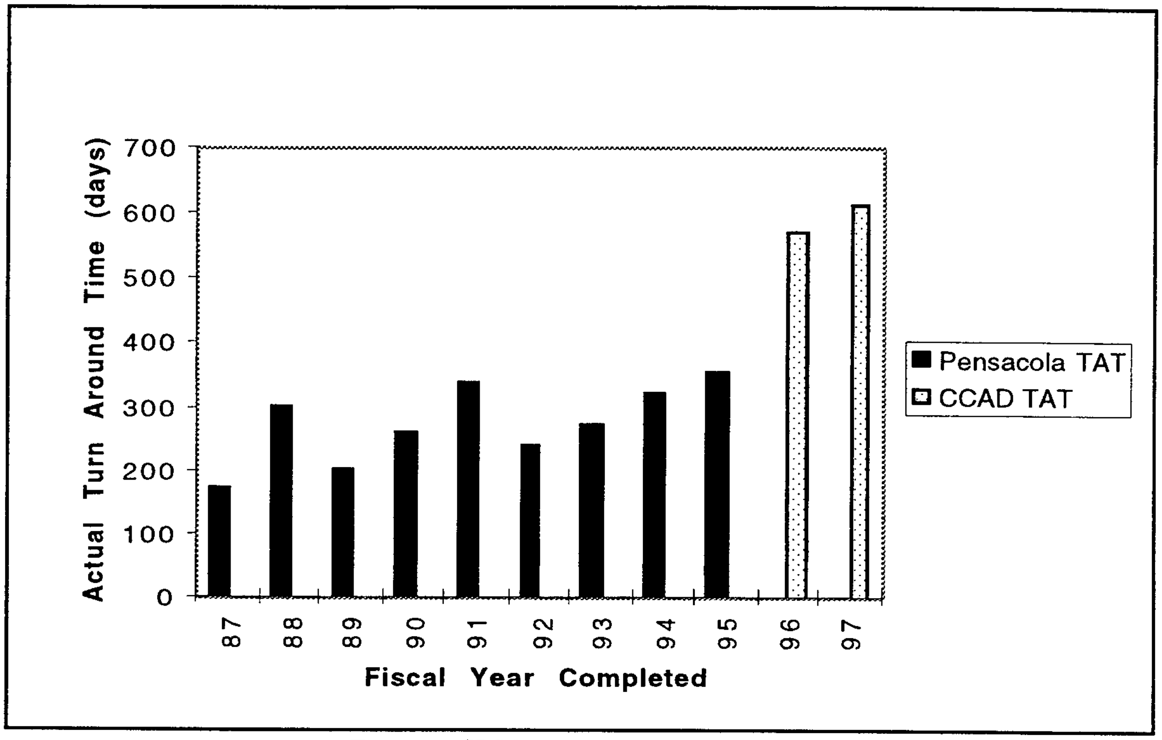

Figure 6 - SDLM Actual Turnaround Time

However, SDLM performance at CCAD cannot be directly compared to NADEP Pensacola or Sikorsky. In addition to delays in transferring necessary SeaHawk support equipment from Pensacola to CCAD, and learning curve effects associated with a different airframe, CCAD developed its own SDLM specification. This specification was not based on the existing Navy specification and incorporates more labor hours than were

22 Naval Air Systems Command Industrial Capabilities Department (NAVAIR 6.0D1), July 1997.

customary at NADEP Pensacola.[23] Nonetheless, the impact to the fleet is a decreased throughput at SDLM, as <u>actual CCAD TAT for FY 1997 was 84 percent higher than planned</u>.

5. Possible Causal Factors of SDLM Trends

Without additional data, it is difficult to determine the exact cause for the dramatic rise in material costs and turnaround time with only slight increases in labor costs. Rising material costs may be more attributable to changes in the price of materials and not necessarily the volume used. Material prices in the Navy Supply System vary greatly from year to year.[24] Fluctuations in material costs may be captured by normalizing costs using Annual Price Change (APC) rates from Navy Supply. Other possible sources of rising costs may be surcharges imposed to cover costs of government oversight (i.e. - Defense Logistics Agency). Regardless of these external factors, it will be shown below that aircraft age is a statistically significant factor in the rising material costs of H-60 depot maintenance. In regard to rising turnaround times, CCAD is reviewing its procedures and is implementing process improvements designed to improve efficiency and reduce turnaround time to approximately one year.[25]

One possible explanation of increasing costs is associated with the costs of Aviation Depot Level Repairable (AVDLR) components. Pricing AVDLRs is a Navy-wide problem. Due to price miscalculations, funding shortfalls in the fiscal year 1998 Flying Hour Program have required an additional $300M for the Navy to develop a new

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23 H-60 Integrated Maintenance Concept Status Meeting, NAS Patuxent River, MD, June 1997.

24 Burgett, Barbara, *An Analysis of the Effects of the Aircraft Service Period Adjustment (ASPA) Program on the Direct Costs of Standard Depot Level Maintenance (SDLM) for the F-14A*, Master's Thesis, Naval Postgraduate School, Monterey, CA, March, 1997, p. 20.

25 IMC Status Meeting, NAS North Island, July 1997.

pricing methodology that will predict AVDLR costs more accurately.[26] At the squadron level, personnel hard-pressed to meet operational requirements may have been tempted to keep the most reliable components available for operational use. The SDLM potentially serves as a means to accomplish this.

For example, the operational squadron likely knows that an aircraft will be out of service for over one year when it fails ASPA. Squadron maintenance may short-change the supply system by installing components that are "barely" Ready For Issue (RFI) on the aircraft going to SDLM and retaining the "best" components for aircraft getting ready to deploy. This would, in fact, drive up material costs at SDLM as these components are likely to fail (through inspection or operational check), while the aircraft is in the hands of the depot. Furthermore, because the depot has lower priority on certain components, reassembly after SDLM would be delayed as aircraft "await parts," increasing overall turnaround time.

Unfortunately, this is just a hypothesis unless quantified. However, analyzing failure rates for AVDLR's by location and organization code may show that an excessive number of non-RFI components are identified when the aircraft is inspected at the depot prior to SDLM induction. Although shifting rework efforts to fleet locations will not eliminate faulty components or the cost of replacement, operational squadrons will have more direct interface with the depot team and will be able to coordinate the use of parts on hand to facilitate completion of depot maintenance.

E. SUMMARY AND OUTLOOK

This chapter has indicated some of the shortfalls of the current ASPA/SDLM process. Depot maintenance for the H-60 has been complicated by issues such as BRAC and reduced funding. Nonetheless, it is evident that current depot maintenance processes

26 1998 DoD Appropriation Bill.

must be changed in order to reduce the turnaround times and the rising costs associated with depot maintenance. Chapter IV introduces a planned alternative, Integrated Maintenance.

IV. THE INTEGRATED MAINTENANCE CONCEPT

A. INTRODUCTION

In 1996, the H-60 program office was directed to change the ASPA/SDLM process. The Integrated Maintenance Concept eliminates the ASPA inspection and conducts Depot Level maintenance in a phased fashion at the operational sites. The Integrated Maintenance Concept is intended to minimize the time an aircraft is unavailable for operational use, integrate the Organizational, Intermediate, and Depot Levels of maintenance for the SH-60 helicopter, and maintain high quality maintenance. Combining these maintenance levels into an integrated process is a radical shift which will take time to complete. This thesis concentrates on the initial aspects of IMC, bringing Depot Level Maintenance closer to organizational units.

B. RATIONALE

The Integrated Maintenance Concept stems from the Affordable Readiness Initiative. Begun in 1996, Affordable Readiness is an effort to reduce Operating and Support (O&S) Costs (approximately 50 to 60 percent of the annual Total Obligational Authority (TOA) within Naval Aviation)[27] and redirect savings towards modernizing and recapitalizing Naval Aviation. In a 1996 Affordable Readiness Memorandum, Commander, Naval Air Systems Command (COMNAVAIRSYSCOM) identified the following methods to reduce O&S Costs:

- *Sustained Maintenance Planning* - Continuous review of our in-service weapon systems to assess and adjust our maintenance structure based on operational feedback.

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27 Leavitt, Col. USMC, NAVAIRSYSCOM, *Affordable Readiness brief to Air Logistics Board Principals*, 27 June 1996.

- *Reliability Improvements* - The achievement of inherent reliability, technology insertion and obsolescence avoidance. This is accomplished using the Reliability Centered Maintenance analysis and Logistics Engineering Change Proposal (LECP) processes.

- *Cycle Time Reductions* - Reduced out of service time for aircraft (Modifications, ASPA, SDLM), spares and support of equipment repair.

- *Manpower Reductions* - Reduction in program team size and O&S manpower requirements.

- *Improved Business Practices* - Cost Effective Partnership with Industry, Digitized Data, Single Process Initiatives, Reinventory Initiatives, Reliability Warranties, & Integrated Diagnostics.

- *Infrastructure Improvements* - Consolidation of capabilities such as: O, I & D Level maintenance facilities, training schools, and data systems.

The Integrated Maintenance Concept for the H-60 airframes combines several of these methods to conduct the proper maintenance, at the proper time and location, and by the best source(s). This is similar to, but more extensive than, shifts in other programs from the ASPA/SDLM process to Phased Depot Maintenance (PDM). Phased Depot Maintenance is essentially a shift towards Depot Level Repairs at scheduled intervals (months in service or aircraft hours) rather than on-condition. Similar to IMC, the objectives of PDM are:[28]

- Improve Aircraft Material Condition

- Improve Operational Availability

- Achieve Full Service Life

- Arrest Escalation of O Level Workload

- Provide Best Return on Depot Investment

28 P-3C Cognizant Field Activity (CFA) briefing notes on PDM, February 1993.

Currently, the F/A-18, AV-8B, P-3C and E-6A aircraft utilize some form of PDM. The Air Force and many commercial activities also use PDM processes. Under Enhanced Phased Maintenance (EPM), the E-6A has obtained a 34 day reduction in out of service time (180 day nominal SDLM cycle) and significant reductions in direct maintenance man-hours per flight hour (for both scheduled and unscheduled O Level maintenance).[29]

C. DESCRIPTION

Ideally, depot level work should be performed on an aircraft where it is needed and when it is needed. Due to its complexity, however, some scheduling must occur to most efficiently accomplish depot work processes. In the past, this has been accomplished by performing mandatory rework of the entire aircraft at a set interval (months in service, flight hours, etc.). The Integrated Maintenance Concept is intended to replace a complete overhaul with several "section" overhauls at specified intervals. For example, if a complete overhaul were to be performed every six years, the depot level work under IMC would divide the aircraft into six sections or areas and perform annual rework on one section at a time. In a six year cycle, the aircraft would undergo complete rework, just as in a process involving complete overhaul once every six years.

D. ADVANTAGES

The Integrated Maintenance Concept has several advantages over the current ASPA/SDLM process of depot maintenance. The concept of major depot work on site has already been validated by the H-60 Block I modification program and associated In-Service Repair programs.[30] Although the rise in ISRs could be attributed to inefficiencies

29 Leavitt, 1996.

30 PEOASWASM, *Prototyping of H-60 ACFT Phase Depot Maintenance (PDM) Field Baselining and Repair Requirements*, Routine Message, 27 March 1997.

of the current process, the solution (more ISRs) may indicate that the process, rather than being improved, should be changed.

Integrating depot and O Level maintenance through IMC at fleet locations has the following advantages:

- Eliminates ferry time and costs for SDLM.
- Eliminates costs required for ASPA inspections.
- Fixed interval scheduling eliminates the subjectivity of ASPA inspections, eliminates queue time at a depot, and facilitates budget planning.
- Maintenance tasks within O Level capability are performed by O Level (squadron) personnel at fleet locations, reducing depot Over and Above costs.
- Depot artisans and O Level personnel share experiences on aircraft usage and operating environment, detection of degraded material condition, and maintenance procedures at each level.
- Eliminates redundant maintenance actions such as disassembly/reassembly for repair (O and D Level repairs are conducted in parallel).
- Eliminates redundant ground and flight checks (would be performed jointly by O and D Level instead of once on transfer and once on receipt of the aircraft).
- Status of the aircraft is readily available to the user (squadron), enhancing planning and scheduling for operational requirements.
- Reduces overhead costs, manpower, inventory, technical data, and facility requirements by capitalizing on industry's strengths.[31]

1. Ferry Costs

Conducting depot maintenance at fleet locations eliminates all costs associated with an aircraft ferry.[32] For traditional SDLM, the aircraft must be flown from the fleet location to the depot and back. Aircrew have daily flight hour limitations, so two days are

31 Leavitt, 1996.

32 Determining actual SDLM ferry costs is beyond the scope of this thesis.

estimated for a typical ferry mission. A calculated average would most likely be higher, however, considering factors such as maintenance/weather delays and the time required to ferry from NAS North Island to the Sikorsky facility at Stratford, CT. Costs associated with ferry flights include fuel, per diem, en route lodging, rental car, lodging at the depot, and commercial air travel back to the fleet location.

Once an aircraft completes SDLM, an aircrew from the fleet squadron travels to the depot to conduct a maintenance acceptance test flight before ferrying the aircraft back to its home base. Cost elements for the return flight are the same as for drop-off. However, the actual fly-away date is often extended beyond what was expected. This is due to inefficiencies in estimating the exact SDLM completion date and the time required to correct and re-test discrepancies discovered during the maintenance test flight. As there is no way to accurately estimate when the aircraft will be ready for ferry, the fleet aircrew typically stays at the depot, waiting for the aircraft to come fully "up."[33] In addition to increased TAD costs, there is an opportunity cost associated with the crew of three (and often an additional inflight mechanic) being absent from normal squadron duties.

Eliminating ferry requirements also has cultural advantages. Because the aircraft remains at the fleet location, a sense of "ownership" resides with the operational squadron. This allows for direct communication with and feedback from depot maintenance personnel rather than making assumptions about condition, schedules, etc. This reinforces the modern theme that depot maintenance is a capability and not a place.

By keeping the aircraft at fleet locations, ferry cost savings may be offset by travel and per diem costs of depot personnel. As discussed below, capturing these costs

[33] During an August 1997 briefing to the Monterey Chapter of the Naval Helicopter Association, one fleet Commanding Officer indicated one crew was at the depot for three weeks.

will be required. However, these costs will not be new to depot maintenance for the H-60. Contractor personnel are already on-site at NAS Mayport and NAS North Island. In government facilities nearby the operational squadrons, they conduct extensive depot maintenance such as modifying SH-60B's to the Block I Upgrade configuration. Also, government depot artisans frequently travel to fleet locations in support of ASPA inspections and In-Service Repairs.

2. Elimination of ASPA

The Integrated Maintenance Concept also avoids problems associated with the current ASPA process. Under IMC, costs of ASPA inspections are eliminated. Also, depot maintenance under IMC is at fixed intervals based on engineering determination and Reliability Centered Maintenance analysis of aircraft degradation. Therefore, subjectivity related to when and what maintenance should occur is eliminated. Air Force and other Navy programs that have shifted to Phase Depot Maintenance are showing improved aircraft material condition, improved readiness, and reduced costs associated with depot maintenance.[34] Conducting maintenance at fixed intervals "facilitates the programming of depot dollars, material requirements, manpower requirements, and facility requirements."[35]

3. Depot Over and Above Costs

When an aircraft enters SDLM at a depot facility, it is inspected to evaluate its material condition and estimate the required work. Many discrepancies found during this inspection fall under the maintenance capabilities found at the organizational level. Since

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34 Washington, Craig, *An Analysis of the Standard Depot Level Maintenance (SDLM) program of the F-14 Tomcat*, Master's Thesis, Naval Postgraduate School, Monterey, CA, June, 1996.

Ramsey, Robert and Legidakes, Leo, *An Analysis of the Impact of ASPA on Organizational and Depot Level Maintenance*, Master's Thesis, Naval Postgraduate School, Monterey, CA, December, 1994.

35 Air Force Technical Office, 1985.

these discrepancies are not a depot requirement, they are either: Noted But Not Corrected (NBNC) or repaired at an Over and Above (O&A) cost to the customer. If they are NBNC'd, the repair occurs after the aircraft is returned to the fleet. Repairs often require additional hours to access the work area and reassemble the aircraft when the repair is complete. The cost of an O&A is higher than what would be incurred if it was performed by O Level maintenance personnel.

E. DEPENDENCIES

The Integrated Maintenance Concept depends on several factors. As discussed in Chapter II, the depot environment is in a state of flux. The need for change (to reduce turnaround time and increase efficiency and operational readiness) is obvious. The exact means to accomplish this, however, are uncertain. Moving any organic depot work will come under scrutiny. "Today, a bipartisan 'Depot Caucus' exists in Congress, most strongly in the House of Representatives. Its aim is to preserve the 60/40 rule, which was created by the caucus' acknowledged leader, Rep. Solomon Ortiz (D-TX). Ortiz' home district .... encompasses the Corpus Christi Army Depot."[36]

The Integrated Maintenance Concept (like other alternatives) also depends on the results of a comprehensive Reliability Centered Maintenance (RCM) analysis for naval H-60s. Over the 15 years that the SH-60B has been in operational service, much has been learned about component life issues such as Mean Time Between Failure (MTBF), structural issues (where rework has been required), and the general "health" of airframes over time. RCM is a continuous quality improvement program designed to:

- Analyze maintenance tasks to group them into blocks.
- Detect problems early through interval-based phase inspections.

36 Kocks, Kathleen, *The Next Moves For Depot Maintenance*, Rotor & Wing, April, 1997.

- Fix problems in the field.
- Design permanent solutions where needed.

RCM has been used to great advantage for maintenance of the AV-8B Harrier II aircraft, which has no conventional depot. Compared to an ASPA/SDLM process, NADEP Cherry Point estimates annual savings of 36 percent using RCM for the AV-8B. For the H-60, estimates are approximately 20 percent.[37] RCM will provide a detailed breakdown that will be used to determine maintenance procedures and intervals to be performed at all levels of maintenance. The initial RCM analysis for the SH-60 is expected to be complete in November 1997. A detailed breakdown of IMC process tasks, intervals, and program costs cannot be developed until final delivery of RCM analysis in April 1998.

F. THE TRANSITION TO IMC

The transition to an Integrated Maintenance Concept will occur over several years. The timeline for the program is presented in Table 7.

Table 7 - Timeline for H-60 Integrated Maintenance

Phase	Fiscal Year	Comments
Baseline Prototype	1997-1998	Funding of $300k/aircraft in place for 8 aircraft.
Baseline Fleet	commence 1998	approx. 102 aircraft
IMC Prototype	1998-1999	approx. 38 aircraft
IMC Implementation	commence 1999	
Steady State IMC	by 2004	279 aircraft

Notes: Aircraft Baselined at Fleet Locations (NAS Mayport/North Island)

37 Somers, 1994.

It is important to note that the Integrated Maintenance Concept for the H-60 is not intended to fully replace Standard Depot Level Maintenance. SDLM will continue to occur during the transition period and beyond under the following circumstances: aircraft that cannot be baselined (i.e.- a material condition inspection determines that a SDLM is required), SDLM in conjunction with major upgrades (e.g. - conversion of an aircraft to SH-60R configuration, completed at contractor locations), and rework in conjunction with crash damage. Also, due to issues beyond the scope of this thesis, it is unknown whether the program will be initiated using personnel from NADEP Cherry Point, CCAD depot artisans, Sikorsky contract personnel, or a combination of each.

G. AIRCRAFT BASELINING

Every aircraft must be baselined before it is entered into Integrated Maintenance. An aircraft is considered baselined if its material condition is such that significant depot maintenance will not be required during the determined interval.[38] Aircraft material condition will be assessed by inspection or by meeting age and status criteria. The H-60 CFA estimates that aircraft meeting the following criteria would be considered baselined: aircraft age less than five years old (SDLM or new delivery since 1993), aircraft remanufactured to the SH-60R configuration, and future SDLM deliveries.[39]

Regardless of how an aircraft is baselined, however, Reliability Centered Maintenance and In-Service Repair results must be continuously utilized to ensure degradations in material condition do not occur faster than the planned depot maintenance interval. If the aircraft is divided into six sections and the overall depot

[38] The use of a six year interval is purely notional and used for discussion purposes only. Actual intervals will be determined by Reliability Centered Maintenance and may even vary between aircraft sections, based on anticipated degradation rates.

39 CFA briefing notes on IMC, 1997.

interval is six years, one section of the aircraft will not receive scheduled depot maintenance until six years after being baselined. For aircraft baselined by the criteria of being less than five years old, one section would theoretically not receive scheduled depot maintenance for ten years. For this reason, additional periodic inspections may be required during the aircraft's first cycle of Integrated Maintenance (six years) to bring each section into its own six year cycle. Otherwise, the trend of increasing In-Service Repair requirements will not be reversed in the long run.

V. ESTIMATING THE DIRECT LABOR AND MATERIAL COSTS ASSOCIATED WITH PERFORMING DEPOT LEVEL MAINTENANCE

A. INTRODUCTION

The purpose of this chapter is to analyze specific variables and their effect on the direct labor and material costs of depot maintenance. All data analyzed in this chapter is from SH-60B SDLMs conducted at NADEP Pensacola. Linear and multiple regression analyses were performed to identify the statistical significance of the explanatory variables and the degree to which the model explains the variation in the dependent variables. The results should aid in estimating the direct costs of depot maintenance under any program.

B. DATA COLLECTION

Production Productivity Reports (PPRs) from NADEP Pensacola were the source of SDLM induction dates, labor man-hours, direct labor cost, and material cost for SDLMs conducted between 1987 and 1995. Raw data from PPRs is contained in Appendix D. Aircraft "new" dates, lot numbers, and locations (squadron and coast) were taken from a data base developed by the author during a previous tour at the Defense Plant Representative Office (DPRO), Owego, NY. The Owego facility is the location of the SH-60B prime contractor, Lockheed-Martin. Aircraft avionics integration is completed at this site prior to delivery to fleet squadrons. Lot numbers and locations were verified using the ASPA data base in Appendix F.

Cost data from PPRs were adjusted to fiscal year 1997 constant dollars by using the composite indices for Operations and Maintenance, Navy/Less Fuel (O&MN/LF) provided by the Naval Center for Cost Analysis (NCCA). These indices, presented in Table 8, were applied to cost data fields based on the SDLM completion date.

Table 8 - O&MN/LF Raw Inflation Indices, Mid-Year 1997

Fiscal Year	Index
1987	0.7528
1988	0.7730
1989	0.8033
1990	0.8344
1991	0.8687
1992	0.8986
1993	0.9277
1994	0.9413
1995	0.9575
1996	0.9765
1997	1.0000

For regression analysis, data were consolidated into a single spreadsheet, also presented in Appendix D. The goal was to determine the effect of explanatory variables on the direct labor, material, and total direct costs associated with SDLM. Regression analysis was performed using the Analysis Toolpack for Microsoft Excel. Regression analysis determines a line defined by $Y = a + b_i(X_i)$, where Y is the dependent variable and X_i is/are the independent variable(s). If i equals one, the model is a linear regression with only one explanatory variable. If i is greater than one, the model is a multiple regression with more than one explanatory variable. The "a" value, the constant term, equates to the y-axis intercept of the line; the "b" values, the coefficients of the independent variables, equate to the slope of the regression line. Using the "least squares method," regression programs determine values of a and b so that the sum of the squared deviations between observations and the fitted line is less than that from any other straight line that could be fitted through the observations.[40] Other outputs of the program

40 Liao, *Cost and Policy Decision Analysis*, 1997.

are t-ratios for constants and coefficients and F-ratios and R-squared values for the solution. An overview of these statistical terms is presented below.[41]

> When analyzing the results obtained from a regression analysis, there are three statistical values which are of great interest to the statistician or manager for determining the validity of the regression model. The first of these values is the t-ratio for the coefficient of the explanatory variable. A high t-ratio indicates that the explanatory variable (also referred to as the independent variable) is important in explaining the value of the dependent variable. For an independent variable to be statistically significant at the 95 percent confidence level, its t-ratio must be higher than the critical value, which is generally around two.[42]
>
> The second statistical value of importance is the F-ratio. The F-ratio is a measure of how well the selected set of explanatory variables model the system. If the F-ratio of a regression model is less than the critical value (approximately four at a 95 percent confidence level), then the chosen set of explanatory variables do not correctly model the system.
>
> The most significant use of the F-ratio in regression analysis is to check the statistical significance of the third value of importance, the coefficient of determination, or R-squared as it is commonly called. The R-squared value measures the percentage of the variability in the dependent variable that can be explained by the regression line (Liao, 1996). Values for R-squared range from zero to 100 percent. R-squared values close to zero indicate a weak relationship between the explanatory and the dependent variables; values close to 100 indicate a strong correlation. As mentioned previously, the statistical significance of the R-squared value is measured by the F-ratio.

41 Burgett, 1997.

42 Positive two for positive coefficients and negative two for variables with negative coefficients.

C. ANALYSIS OF RESULTS

1. Linear Regression Models

Using aircraft age at SDLM induction as the explanatory variable, the results of linear regressions are presented in Table 9. A graphic depiction of the regression results for total direct costs (labor plus material) is presented in Figure 7.

Table 9 - Linear Regression Results

	a	t-ratio, a	b	t-ratio, b	F-ratio	R-squared
Direct Labor	131752	8.47	4963	1.85	3.44	6.6 %
Material	-4663	-0.04	85171	4.22	17.81	26.7 %
Total Direct	127089	0.99	90133	4.10	16.83	25.6 %

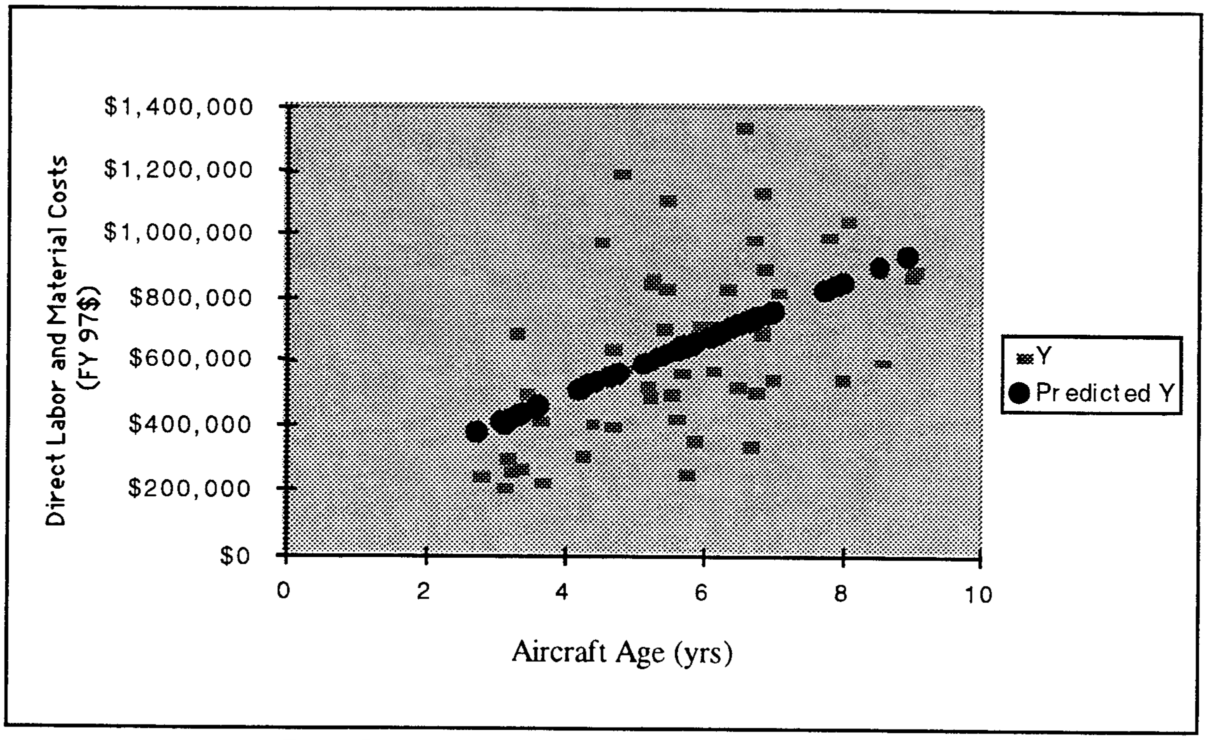

Figure 7 - Linear Regression Results, Total Direct Costs

For the data analyzed, aircraft age is not statistically significant for explaining direct labor costs, as indicated by the t-ratio being 1.85 (less than 2.0). Also, because the F-ratio is less than four, aircraft age does not correctly model the direct labor costs.

Aircraft age is, however, statistically significant in explaining material costs (t-ratio = 4.22). It explains 26.7 percent of the material costs, as indicated by the R-squared value. Aircraft age also is statistically significant (t-ratio = 4.10) and it explains 25.6 percent of the total direct costs. The equation for the fitted line for total direct costs is:

Total Direct Costs,($) = $127089 + [90133,($/yr)] times [aircraft age, (yr)]

This regression analysis also corresponds to the depiction of the data in Chapter III, Figure 2. The graphic depiction in Figure 7 indicates the large variability in the data.

Direct labor costs are a function of the labor hours expended and the current labor rate. It was assumed that this was not factored into the PPR data base, so an approach was developed to adjust direct labor costs based on fluctuations in labor rates. Labor rates for the period were approximated by dividing the direct labor costs (in FY 1997 dollars) by the labor hours expended for each bureau number and then averaged for the entire data set.[43] From the given data, labor rates for NADEP Pensacola SDLMs averaged $23.54 with a median of $23.34. The mean was used to inflate or deflate (relative to the calculated labor rate for each bureau number) the FY 1997 direct labor costs. Another regression analysis, presented in Table 10, was performed on this data.

Table 10 - Linear Regression Results

	a	t-ratio, a	b	t-ratio, b	F-ratio	R-squared
Adjusted Direct Labor	114140	5.97	8311	2.53	6.40	11.5 %
Material	-4663	-0.04	85171	4.22	17.81	26.7 %
Total Direct	109477	0.84	93482	4.17	17.42	26.2 %

[43] This is a rough estimate only and does not factor possible differences in the labor rates and workloads between the various workcenters conducting depot maintenance.

These results did show that, when corrected for labor rate fluctuations, aircraft age does become statistically significant in explaining direct labor costs. However, the R-squared value indicates that only 11.5 percent of the total variation in costs is explained by aircraft age. The overall model is improved, with an R-squared of 26.2 percent, but it is apparent that the model could be improved using multiple regression and additional explanatory variables.

2. Introduction of Work Standard

To improve the model for estimating SDLM costs, Work Standard (the projected amount of labor hours, based on the SDLM specification) was introduced as an explanatory variable. Linear regression results are presented in Table 11.

Table 11 - Linear Regression Results

	a	t-ratio, a	b	t-ratio, b	F-ratio	R-squared
Direct Labor	180489	2.37	-3	-0.26	0.07	0.1 %
Material	2250755	5.04	-310	-3.99	15.91	24.5 %
Total Direct	2431244	4.79	-313	-3.55	12.61	20.5 %

From the small t-ratio, it is apparent that Work Standard is statistically insignificant in explaining direct labor costs. While the results are statistically significant for material and total direct costs, closer examination reveals that the regression solution coefficient for work standard is a <u>negative</u> number. This shows that, for the given set of data, Work Standard is questionable as an explanatory variable; the estimated costs <u>decrease</u> with increasing planned workload.

Three multiple regression models were developed using work standard and aircraft age as explanatory variables and costs as the independent variables. Results are presented in Table 12.

Table 12 - Multiple Regression Results

	Adjusted Direct Labor		Material Costs		Total Costs	
F-Ratio	3.77		12.72		11.19	
R-Squared	13.6 %		34.6 %		31.8 %	
Variable	Coefficient	T-ratio	Coefficient	T-ratio	Coefficient	T-ratio
Constant	16812	0.18	1292924	2.36	1309736	2.12
Work Standard	15	1.07	-201	-2.42	-186	-1.98
Aircraft Age	10215	2.73	59780	2.73	69995	2.83

Similar to linear regression results, the Work Standard in the multiple regression model is only marginally statistically significant in explaining direct costs associated with these SDLMs. The regression solution coefficient for work standard is again a negative number (-201 for material costs and -186 for total costs). These results imply that the Work Standard, what is used to make general estimates of the work to be performed, is either inaccurately presented in the PPR data or is not representative of the actual costs associated with SDLM.[44]

3. Other Explanatory Variables

Subsequent multiple regression models were developed to evaluate the significance of other variables in SDLM direct costs. Independent variables included coast, squadron, and lot number. No significant correlations were found for direct labor costs. The best overall model for material costs was determined using aircraft age and whether or not the aircraft was in the inventory of either of the two SH-60B Fleet Replacement Squadrons. Both variables were statistically significant (t-ratios of 4.9 and

[44] It is also possible that limited SDLM funding required reductions in the specification without considering that SDLM costs were increasing with aircraft age.

2.4, respectively), and the model produced an F-ratio of 12.6 and an R-squared value of 34.4 percent.

D. CONCLUSIONS

The results show a weak, but statistically significant correlation between the independent explanatory variables, age and squadron type, and the dependent variables, historical SDLM direct costs. Introducing work standard, which would seem to be a solid estimate of the SDLM workload and costs, degraded the estimate. Although increasing the scope of the analysis to include other explanatory variables would improve the results of the regression estimate, a significant portion of variability may likely remain with the NADEP Pensacola PPR data, as indicated by the scatter in Figure 7. Nonetheless, the ability to accurately and fully predict the direct costs of depot maintenance should continue to be investigated. Variables which could generate a model that more fully estimates the costs of depot maintenance include the following:

- Total flight hours.
- Shipboard flight hours.
- Recent flight hours (e.g. - 12 months prior to SDLM).
- Number of deployments.
- Aircraft configuration (lot number, Block I upgrade, etc.).
- ASPA deferrals.
- Number of discrepancies found during ASPA.
- Aircraft modifications in conjunction with rework.
- In-Service Repair hours prior to depot maintenance.
- O Level maintenance man-hours per flight hour prior to rework.

Gathering these data would most likely require reviewing aircraft logbooks. Currently, collecting depot maintenance data is limited by the wide variety of sources and the difficulty in obtaining particular data from these sources (i.e. - the data is either not available or not provided for analysis). This highlights the fact that data analysis depends on the quantity and quality of the data. Future depot maintenance efforts should diligently track and maintain data that could be indicative of an aircraft's material condition. Given a reliable estimate of depot maintenance tasks (known processes such as removal, inspection, and replacement) and trend analysis of the time and material expended to correct common deficiencies, a model that estimates a portion of depot maintenance costs could be developed. If this portion is significant, these estimates could then help program funding based on expected entries into depot maintenance.

VI. ESTIMATING AND CAPTURING COSTS ASSOCIATED WITH THE INTEGRATED MAINTENANCE CONCEPT

A. INTRODUCTION

This chapter discusses an approach to estimating and capturing costs for depot maintenance under the Integrated Maintenance Concept. First, differences between traditional public and private contracts are discussed. Under the assumption that both contractor and government personnel will perform depot maintenance under the Integrated Maintenance Concept, no specific conclusions are drawn regarding the optimum source of depot maintenance (i.e. - public vs. private competition). A comparative cost analysis between the current ASPA/SDLM process and the Integrated Maintenance Concept is beyond the scope of this thesis. This reflects the fact that IMC transcends traditional factors in cost studies such as: levels of maintenance (integration of O and D Level), source selection (public versus private), and standardized work packages (RCM analysis versus SDLM specification). This chapter does, however, serve as a basis for cost considerations under IMC.

B. PUBLIC AND PRIVATE CONTRACTS FOR DEPOT MAINTENANCE

Contracts for depot maintenance with private organizations, such as Sikorsky, typically include three elements. First, the Basic Fixed Price element captures costs of known processes required for the work effort. These types of processes include disassembly, inspection, and reassembly. The second portion is a Fixed Price Over and Above Price for expected costs associated with specific processes, material and component requirements encountered during the rework. Finally, emergent labor costs associated with the rework are charged at a Fixed Price Over and Above rate. Workload content is determined by contract line items for the baseline workload plus Over and Above items approved by the government Contracting Officer.[45]

Public depots, on the other hand, summarize maintenance costs as an average total cost per SDLM. Costs include material, Indirect and General and Administrative (G&A) Overhead, direct labor, and Government Equipment/Material/Services. Workload content is determined by Job Orders, issued according to the contract specification. "Basic" Job Orders are those not involving corrective action or repair. "Over and Above" Job Orders are those involving corrective or repair actions.[46]

Because of the contractual differences in how depot maintenance is executed, estimating total costs for Integrated Maintenance will require strong cooperation between public and private depots and careful analysis of how costs are applied. In today's "teaming" environment, traditional barriers between government and industry are being eliminated. These trends will facilitate sharing process and cost data to develop a depot maintenance plan that most effectively meets operational requirements.

C. COST ESTIMATION

Chapter V and similar studies[47] indicate that estimating airframe rework cost using explanatory variables is a complex process with results that predict some, but not all, cost variations. A better regression estimate for the H-60 would require more detailed dependent variables (i.e. - further breakdown of direct costs) as well as additional explanatory variables. Considering the radical shifts involved with Integrated Maintenance, one may argue that regression analysis of traditional SDLM costs is irrelevant. The approach, however, is suitable once sufficient data are obtained.

45 Stoll, L. (AIR-4.2). *Public/Private Airframe Rework Cost Comparison Study*, November, 1996.

46 Ibid.

47 Levy, March 1991. Burgett, March 1997.

The costs anticipated for Integrated Maintenance can be allocated to categories similar to the current costs of In-Service repairs by government depot artisans and the depot maintenance performed by Sikorsky at fleet locations. The labor and material costs associated with these programs can be used to estimate future costs, given variables such as aircraft age, hours, an accurate work package estimate, labor rates, etc. This approach, coupled with the outcome of RCM analysis (better estimates of the time and degree of degradation of aircraft components and material condition) should produce results that can be used to accurately schedule aircraft and program funding for Integrated Maintenance.

Similarly, full implementation of Integrated Maintenance for the H-60 is scheduled for 1999. Prior to that time, extensive data can be obtained from the baselining and IMC prototyping efforts. Regression and trend analysis of this data should also serve to estimate future depot maintenance costs at fleet locations.

D. COLLECTION AND ANALYSIS OF COST DATA

It is well known that good analysis begins with good data. The purpose of this section is to discuss successful data acquisition and identify specific costs that should be tracked for depot maintenance programs.

1. General

Despite scope limitations, the efforts expended in gathering, correlating, deconflicting, and consolidating data for this thesis indicate the need to change the way depot maintenance data is managed. The data must capture current and historical time and cost elements that will allow managers to identify trends and optimize maintenance procedures. The data must also be in a suitable format. For example, an Excel Spreadsheet was used for SDLMs conducted at NADEP Pensacola. It subtracted the production date from the induction date to calculate airframe age; it subtracted induction date from completion date to verify turnaround time. It became immediately apparent that data from the PPRs were incompatible. For example, dates were in Julian Date format. All values had to be manually converted to calendar dates. In short, accurate, consistent, and timely data is required for management decisions to be more informed and cost effective. The following modifications are recommended to improve data collection and analysis tasks associated with depot maintenance:

- Incorporate modern technology, such as bar coding of events and materials, to document hours and material costs. These systems can capture time, cost, and task elements with minimal interference to the work process.[48]
- Data should be obtained and analyzed so that recurring reports can provide details of costs (or hours) charged against specific maintenance tasks accumulated against a particular aircraft.
- A common, standard system should be utilized by all locations and by all personnel involved with depot maintenance (depot, contractor, organizational level, etc.). Personnel should be trained on proper inputs to the system.
- Data should be compiled such that a relational data base program can be utilized to search for specific data, summarize data elements by criteria (e.g. - process, location, aircraft age, etc.), and analyze trends of the data.[49]
- Data must be captured to ensure costs can be traced to the proper program. For example, some aircraft will undergo depot maintenance concurrent with an upgrade to the Block I configuration. Data collection must provide for separating costs to each program.
- A sufficient volume of maintenance data should be archived for future analysis. A fixed time interval (e.g. - retaining data for only two years) should be avoided as some tasks may not occur in sufficient volume to allow analysis which provides statistically significant results.

[48] The use of bar coding for labor hours is already in place at Sikorsky's modification hangar at NAS North Island.

[49] Commercially available programs such as Microsoft Access are ideal, but are complex and not as widespread as spreadsheet programs (e.g. - Excel and Lotus). Relational data bases can, however, easily access and analyze data contained in spreadsheets.

Tracking of costs should utilize a combination of NADEP's current procedures for capturing costs and hours associated with In-Service Repairs and Sikorsky's tracking of costs and hours for aircraft maintenance and modifications conducted at fleet locations. As previously discussed, data must be consistent and accurate to be adequately analyzed. The information contained in Appendix H uses "standard" hours per task for approximating the workload required for depot maintenance. It is important to emphasize that work standards should not be equated to costs. The most reliable means to estimate future costs is through the analysis of historical costs combined with accurate estimates of workloads, labor rates, and material requirements.

2. Aircraft Variables

Certain data should be recorded each time an aircraft enters depot maintenance. At a minimum, fields should include:

- Aircraft Type/Model/Series.
- Bureau Number.
- Aircraft configuration (lot number, Block I upgrade, etc.).
- Flight hours.
- Aircraft Age.
- Aircraft time in tour (since previous depot maintenance).
- Level of previous depot maintenance (SDLM, ISR, IMC baseline, etc.).
- Scope of work planned (IMC baseline, section rework, etc.).
- Estimated hours required (total and by process, based on work package and P&E prior to starting work).
- Estimated material requirements (total and by process, based on work package and P&E prior to starting work).
- Modifications to be performed in conjunction with depot maintenance.

Additional desired data includes:

- Number of deployments since last depot maintenance.
- Detailed flight hour data (shipboard, prior 12 months, etc.).
- Recent flight hours (e.g. - 12 months prior to SDLM).
- ASPA deferrals (if applicable).
- In-Service Repair hours prior to depot maintenance.

These data should be collected using standard formats among all organizations participating in Integrated Maintenance. This would allow the data to be easily incorporated into a consolidated data base to be used for overall tracking and analysis.

3. Capturing Direct Costs

Direct costs are those costs which can be directly traced to maintenance performed on a specific aircraft. Direct costs are associated with specific processes, such as: disassembly, inspection, repair, reassembly, systems test, surface conditioning, paint, ground/flight tests. The following list of direct costs associated with depot maintenance should be tracked during IMC processes:

- Labor hours and rates expended during inspection and preparation. These should be broken down by: O Level, D Level and contractor participation, aircraft section, skill area, and Standard vs. Over and Above hours and rates.
- Labor hours and rates expended in effecting repairs. These should be broken down by: O Level, D Level and contractor participation, aircraft section or component, skill area, and Standard vs. Over and Above hours and rates.
- Cost of component repairs that are beyond the capability of on site maintenance (i.e. - AVDLRs).
- Material costs. These should be broken down by the type of material, skill area, and location of the repair.

- Consumable material costs. These are materials that are used for a specific aircraft but are not traceable to specific locations or components (e.g. - rivets, paint, etc.).

Labor rates should be traceable to specific tasks and not include factors that are normally considered indirect costs. During an IMC status meeting, it was stated that labor rates for government depot artisans would be approximately 2.5 times greater than Sikorsky's labor rate (actual values are considered "business sensitive"). This was due to the fact that Sikorsky personnel are already on site and the government must account for travel and per diem costs. Including travel and per diem as direct costs would complicate analysis of depot maintenance performance under IMC.

4. Capturing Indirect Costs

Indirect costs are those costs that cannot be traced to a cost object, such as a specific bureau number. Indirect costs are proportionally allocated to cost objects using a defined basis. For depot maintenance, there is a "causal relation" between the indirect costs and the cost object (i.e. - the indirect costs are a result of the requirement to conduct depot maintenance). Therefore, accumulated indirect costs should be allocated to bureau numbers using a consistent and identifiable basis such as the total rework hours or the number of days the aircraft spends at the depot facility. Metrics should be incorporated into the Integrated Maintenance program to capture indirect costs such as:

- Travel
- Per Diem
- On-site management.
- Management and Engineering Support (PMA, CFA, Contractor, etc.).
- Support materials (reusable storage containers, bubble wrap, etc.).

- Facility and equipment costs.

5. A Sample Cost-Capturing Model

Appendix H contains a spreadsheet sample form that could be used for capturing direct costs associated with Integrated Maintenance. This sheet was developed using process and work standard information obtained from NADEP Cherry Point. The spreadsheet is used to document specific tasks performed under IMC, who performed those tasks, and the actual hours expended on the tasks. Work standards are merely a reference. They should be updated as required to ensure planned workloads accurately reflect actual workloads. This facilitates the programming of funds based on work content for the depot maintenance at fleet locations.

Once sufficient data is obtained during baseline and IMC prototype processes, managers can use the data to project costs based on: average hours required per section, average hours required per task, average hours required for corrosion work, average hours required for test, etc. Once hour values are determined, the cost can be calculated using defined labor rates for O level, D Level (Cherry Point or CCAD) and contractor (Sikorsky or Lockheed-Martin) personnel. The addition of component repair and the indirect costs mentioned above could then be incorporated to determine a total cost for a particular phase of depot maintenance This analysis should also include probabilities of task occurrence, who performs the work, and the labor rate, so that managers can estimate the total maintenance costs of IMC (i.e. - over a complete IMC cycle).

E. SPECIFIC COST ISSUES

This section describes specific issues that require special attention during the transition to Integrated Maintenance.

1. On Site Trend Analysis

Prior to beginning Integrated Maintenance (to include baseline and prototype efforts), metrics should be developed that allow performance analysis. Trends in cost and time should be identified at the lowest level possible, such that estimates for specific processes can be refined. For example, if a task consistently (i.e. - among sites and sources) requires 20 percent more labor hours than originally estimated, the work standard should be updated to facilitate more accurate future estimates. Actual repair hours and material costs should also be compared to estimates from P&E inspections. Excessive variations should be investigated. Similar "flags" should occur at the site level to detect excessive ratios of Over and Above costs to standard costs.

2. Organizational Level Maintenance Under IMC

O Level workload under Integrated Maintenance must be investigated. Previous reports have identified an increase in O Level maintenance man-hours as a result of the ASPA process.[50] Other aircraft have realized an excessive number of discrepancies found during ASPA inspections that should have been discovered under normal, scheduled O Level maintenance. For example, out of 2200 discrepancies found during recent H-53 ASPA inspections, 1900 should have been identified and corrected at the O Level prior to the ASPA inspections.[51] Combining these two trends raises the question of whether O Level man-hours are being used to improve aircraft appearance (i.e.- ASPA grooming) versus actually improving the aircraft's material condition. Introducing IMC for the H-60 will place greater emphasis on conducting necessary repairs at the proper time and by the proper level of maintenance. By providing better exchange between depot and organizational personnel, it is possible that O Level maintenance man-hours could

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50 Ramsey, Legidakes, 1994, p 21.

51 Interview with CFA, April 1997.

increase under IMC. Therefore, it is necessary to track unscheduled O Level maintenance man-hours and In-Service Repairs by depot personnel in order to determine any shifts in maintenance workload. At a minimum, O Level Maintenance Requirement Cards (MRCs) should be updated to complement IMC. A comparison of trends between aircraft entering IMC and those remaining in the current SDLM process would indicate how the material condition of the aircraft is being determined and corrected and if total costs are being reduced or if costs are being transferred from one level to another.

3. Challenges of IMC

The goals of depot maintenance should include decreasing the amount of unscheduled maintenance and minimizing variability in material costs, labor costs, and turnaround time. These should be attainable through close linking of engineering analysis of requirements and firm scheduling of maintenance intervals and processes. The lead time for materials and components must also be anticipated. Any change to maintenance processes requires time to stabilize. For example, baselining efforts are used to determine what specific tasks should be accomplished. Baselining should be very detailed and may initially require more inspections to evaluate aircraft material condition, possibly increasing short term costs. Once processes and intervals are defined, however, Integrated Maintenance has the potential to offer efficiency and cost improvements over traditional depot maintenance.

VII. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

This thesis has described issues related to the current and proposed depot maintenance plans for naval H-60 helicopters. The analysis focused on trends of the current ASPA/SDLM process, advantages of the proposed Integrated Maintenance Concept (IMC), estimating costs of SDLM historical data using multiple regression analysis, and identifying and documenting IMC costs. The following can be concluded:

- Under the ASPA program, the wide variations in aircraft age at SDLM induction have complicated depot maintenance scheduling.
- Under the ASPA program, the time interval to required depot maintenance (SDLM) is reduced by approximately three years for aircraft having undergone previous SDLMs. A fixed Operating Service Period does not account for this trend.
- Regression analysis showed a weak correlation between aircraft age and employment and the direct labor costs of depot maintenance. Material costs showed a higher correlation. 34.4 percent of the variation in total direct costs was explained using these variables.
- Regression analysis showed a negative correlation between Work Standard and actual direct labor and material costs of SDLMs conducted at NADEP Pensacola.
- The current trends in depot maintenance (increasing costs, increasing turnaround time, and reduced capacity due to funding) indicate a need to develop an alternative approach to depot maintenance.
- Increasing requirements for In-Service Repair support the opportunity to conduct more in-depth depot maintenance at fleet locations (i.e. - a more permanent capability).
- Reliability Centered Maintenance analysis should provide useful information to improving depot maintenance scheduling and specific work processes.

- Consolidating organizational and depot level maintenance at fleet locations through an Integrated Maintenance Concept offers several advantages over traditional depot maintenance methods.

- Depot level maintenance programs need time to stabilize and become most efficient.

B. RECOMMENDATIONS

- Shift H-60 depot maintenance from an "on-condition" to "on-time" interval based scheduling.

- Pursue Integrated Maintenance at fleet locations.

- Utilize the data collection techniques presented on page 52.

- Utilize direct labor, material, and indirect costs from IMC baseline prototypes to estimate full costs of Integrated Maintenance.

- Anticipate increased numbers of aircraft requiring depot level maintenance

C. FURTHER RESEARCH

This thesis identified the complexities associated with planning a depot maintenance program. Identifying and estimating costs are crucial for decision makers choosing between maintenance alternatives. The variables included in this analysis captured approximately 34 percent of the total variation in depot maintenance costs under the current ASPA/SDLM process. Reliability Centered Maintenance will assist in estimating depot maintenance processes and costs. Once sufficient data is obtained, adding probabilities of occurrence and specific depot activities' cost drivers can lead to better models for estimating the total costs of depot level maintenance under an Integrated Maintenance Concept. The model presented in this thesis can be used to capture cost data of initial maintenance processes under Integrated Maintenance and serve to estimate actual costs as the Integrated Maintenance Concept progresses from baselining to a steady state flow of naval H-60 helicopters. Identifying and incorporating additional explanatory variables, such as recent flight hours, deployments, In-Service Repair hours, and component Mean Time Between Failures, would also help to refine scheduling and the cost estimation regression models presented in this thesis.

APPENDIX A

LIST OF ACRONYMS

ACRONYM		DEFINITION
A&T	-	ACQUISITION AND TEST
ACC	-	AIRCRAFT CONTROLLING CUSTODIAN
AIMD	-	AIRCRAFT INTERMEDIATE MAINTENANCE DEPARTMENT
AMSR	-	AVIATION MAINTENANCE SUBSYSTEM REPORT
APC	-	ANNUAL PRICE CHANGE
APN	-	AIRCRAFT PROCUREMENT, NAVY
APSA	-	AIRCRAFT SERVICE PERIOD ADJUSTMENT
ASOD	-	AIRCRAFT SQUADRON OPERATING DETACHMENT
ATMSR	-	AVIATION TYPE MODEL SERIES REPORT
AVDLR	-	AVIATION DEPOT LEVEL REPAIRABLE
AWP	-	AWAITING PARTS
BRAC	-	BASE REALIGNMENT AND CLOSURE
BUNO	-	BUREAU NUMBER (AIRCRAFT SIDE NUMBER)
BUPERS	-	BUREAU OF PERSONNEL
CCAD	-	CORPUS CHRISTI ARMY DEPOT
CETS/NETS	-	CONTRACTOR/NAVY ENGINEERING TECHNICAL SERVICES
CFA	-	COGNIZANT FIELD ACTIVITY
CNA	-	CENTER FOR NAVAL ANALYSIS
COMNAVAIR SYSCOM	-	COMMANDER, NAVAL AIR SYSTEMS COMMAND
CVW	-	CARRIER AIR WING
D LEVEL	-	DEPOT LEVEL
DLA	-	DEFENSE LOGISTICS AGENCY
DLR	-	DEPOT LEVEL REPAIRABLE
DMISA	-	DEPOT MAINTENANCE INTERSERVICE AGREEMENT
DoD	-	DEPARTMENT OF DEFENSE
DPRO	-	DEFENSE PLANT REPRESENTATIVE OFFICE
EPM	-	ENHANCED PHASE MAINTENANCE
FHP	-	FLYING HOUR PROGRAM
FRS	-	FLEET REPLACEMENT SQUADRON
G&A	-	GENERAL AND ADMINISTRATIVE
HC	-	HELICOPTER COMBAT SUPPORT SQUADRON
HM	-	HELICOPTER MINE COUNTERMEASURES SQUADRON
HONA	-	HEALTH OF NAVAL AVIATION
HS	-	HELICOPTER ANTISUBMARINE SQUADRON
HSL	-	LIGHT HELICOPTER ANTI-SUBMARINE SQUADRON
IMA	-	INTERMEDIATE MAINTENANCE ACTIVITY
IMC	-	INTEGRATED MAINTENANCE CONCEPT
I LEVEL	-	INTERMEDIATE LEVEL
ISR	-	IN-SERVICE REPAIR
LAMPS	-	LIGHT AIRBORNE MULTI-PURPOSE SYSTEM
LECP	-	LOGISTICS ENGINEERING CHANGE PROPOSAL
MCAS	-	MARINE CORPS AIR STATION
MDRCC	-	MAINTENANCE DATA RECORD CONTROL CODE

MMHISST	-	MULTI-MISSION HELICOPTER IN-SERVICE SUPPORT TEAM
MODS	-	MODIFICATIONS
MRC	-	MAINTENANCE REQUIREMENT CARD
MTBF	-	MEAN TIME BETWEEN FAILURE
NADEP	-	NAVAL AVIATION DEPOT
NADOC	-	NAVAL AVIATION DEPOT OPERATIONS CENTER
NAESU	-	NAVAL AVIATION ENGINEERING SERVICES UNIT
NAMP	-	NAVAL AVIATION MAINTENANCE PROGRAM
NAS	-	NAVAL AIR STATION
NAVAIR	-	NAVAL AIR SYSTEMS COMMAND
NBNC	-	NOTED BUT NOT CORRECTED
NCCA	-	NAVAL CENTER FOR COST ANALYSIS
O&MN/LF	-	OPERATIONS AND MAINTENANCE, NAVY/LESS FUEL
O&S	-	OPERATING AND SUPPORT
O LEVEL	-	ORGANIZATIONAL LEVEL
OPNAVINST	-	OPNAV INSTRUCTION (NAVY)
OSP	-	OPERATING SERVICE PERIOD
P&E	-	PLANNING AND EVALUATION
PDM	-	PHASE DEPOT MAINTENANCE
PED	-	PERIOD END DATE
PEOASWASM	-	PROGRAM EXECUTIVE OFFICER, AIR ANTI-SUBMARINE WARFARE, ASSAULT, AND SPECIAL MISSION (PMA-299)
PPR	-	PRODUCTION PRODUCTIVITY REPORT
PSR	-	PRODUCTION STATUS REPORT
RCM	-	RELIABILITY CENTERED MAINTENANCE
RFI	-	READY FOR ISSUE
SDLM	-	STANDARD DEPOT LEVEL MAINTENANCE
SSI	-	STRUCTURAL SIGNIFICANT ITEM
TAT	-	TURNAROUND TIME
TMS	-	TYPE, MODEL, SERIES (AIRCRAFT/ENGINE)
TOA	-	TOTAL OBLIGATIONAL AUTHORITY
VAMOSC	-	VISIBILITY AND MANAGEMENT OF OPERATING AND SUPPORT COSTS
WCS	-	WORKLOAD CONTROL SYSTEM
WUC	-	WORK UNIT CODE
WWW	-	WORLD WIDE WEB

APPENDIX B

NAVAL H-60 DESCRIPTIONS

Although the airframes are essentially identical, there are major differences in the avionics and operational employment of Naval H-60 Helicopters.

SH-60B

The SH-60B was first introduced into fleet service in 1983 as the Light Airborne Multi-Purpose System (LAMPS Mk III) replacement for the SH-2F. Designed to operate at extended ranges, the SH-60B performs missions including Anti-Surface Warfare (ASUW), CV middle/outer zone Anti-Submarine Warfare (ASW), Vertical Replenishment (VERTREP), Search and Rescue (SAR), and Medical Evacuation (MEDEVAC). The SH-60B model currently exists in three basic configurations: the original Block 0, the Block I upgrade (incorporating improvements such as GPS navigation and the Penguin Anti-Ship Missile), and a limited number of airframes modified for operations in the Middle East (self protection equipment and VHF radio capability). LAMPS Mk III is a fully integrated weapon system, using a secure, full-duplex, digital data link to exchange sensor data, navigation information, system status, system commands, and voice communications between the helicopter and ship. The SH-60B is depicted in Figure 1.

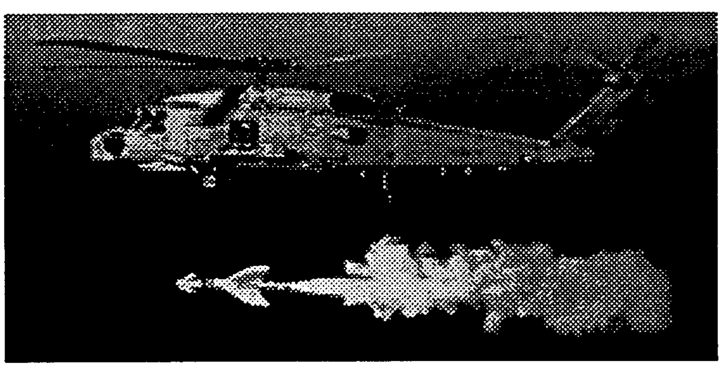

Figure 1
SH-60B SeaHawk

Detachments consisting of one or two aircraft and approximately 20 personnel from a Light Helicopter Anti-Submarine ("HSL") Squadron deploy aboard specifically configured OLIVER HAZARD PERRY (FFG 7) class Guided Missile Frigates, SPRUANCE (DDG

963) class Destroyers, KIDD (DDG 993) class Guided Missile Destroyers and TICONDEROGA (CG 47) class Guided Missile Cruisers. There are currently 12 HSL squadrons operating approximately 170 aircraft.

SH-60F and HH-60H

The SH-60F, known as the CV-Helo, was first delivered to the Navy's Helicopter Anit-Submarine ("HS") squadrons in 1989. The SH-60F is designed for inner zone ASW protection of aircraft carrier battle groups as the replacement airframe for the SH-3H Sea King. The SH-60F also performs SAR and Medevac missions. In the SH-60F, all LAMPS Mk III avionics and equipment have been removed and replaced with integrated ASW mission avionics including a dipping sonar, improved tactical navigation computers, Doppler based automatic approach to hover, and an extra weapons pylon allowing the carriage of three Mk 50 homing torpedoes and/or auxiliary fuel tanks. The SH-60F is depicted in Figure 2.

Figure 2
SH-60F SeaHawk

The HH-60H, also first delivered to the fleet in 1989, deploys as an augmenting force with the HS squadrons to perform combat SAR and Special Forces missions. Although the ASW mission avionics on the SH-60F are removed, the cockpit and navigation systems of the HH-60H are essentially identical to the SH-60F. The HH-60H also incorporates self protection equipment such as Engine Infrared Suppressors, crew-served 7.62 miniguns, RADAR Warning Receivers, and flare/chaff dispensers. The HH-60H is depicted in Figure 3.

Figure 3
HH-60H SeaHawk

HS squadrons deploy aboard aircraft carriers with a mix of SH-60F and HH-60H aircraft (typically 4 F's and 2 H's). There are currently eight HS and two Helicopter Combat Support ("HCS") squadrons (U. S. Naval Reserve) operating approximately 77 SH-60F and 42 HH-60H aircraft. HCS aircrews are highly trained to perform Special Operations missions in the HH-60H aircraft.

FUTURE H-60'S

No new procurements of any SH-60 variant are currently planned. Planned upgrades to the existing models are a Forward Looking Infra Red (FLIR) sensor and Hellfire Air to Surface Missiles with LASER target designator. Approximately 130 of these kits are planned. Equipping some aircraft with the GAU-16 50 caliber crew served weapon is also a possibility.

An SH-60 remanufacture program is planned for FY 1998 and beyond. It will combine the SH-60B and SH-60F into one common ASW/ASUW platform, the SH-60R. In addition to being a complete airframe remanufacture and service life extension plan, the SH-60R will have greatly enhanced mission capabilities including a "glass" cockpit, a Multi-mode radar with Inverse Synthetic Aperture Radar (ISAR) capability, Advanced Low-Frequency Sonar (ALFS), and Integrated Self Defense. The maximum take-off weight of the SH-60R will increase from approximately 21,700 pounds to the 23,500 pound range. This has raised concerns about shortening the lives of dynamic components, revising maintenance schedules, and increasing overall life cycle costs of the SH-60.

The only new H-60 planned for the Navy is the CH-60. This version will have some similarities to the Army's UH-60 BlackHawk (tail wheel is aft and internal cargo capacity is greater), but will incorportate engines, dynamic components such as rotor assemblies, and the cockpit configuration of the naval H-60's. The CH-60 is intended to replace aging CH-46D aircraft for VERTREP and Logistics missions. It may also provide an airborne minesweeping capability. The total buy is approximately 130 aircraft and a contract for an initial 42 aircraft was signed in July 1997 (*Rotor and Wing*, August, 1997).

The naval H-60 inventory plan is depicted in Appendix C.

APPENDIX C - H-60 INVENTORY PLAN

USN H-60 AIRCRAFT MASTER PLAN

FY	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
SH-60B																				
Block I Production Deliveries	12	7																		
Block O Total ACFT	105	82	60	38	32	26	20	0	0	0	0	0	0	0	0	0	0			
Block I Total ACFT	49	71	94	116	132	132	132	132	112	92	72	52	32	12	0	0	0			
Block I Retrofit WIP	9	17	14	14	0	0	0	0	0	0	0	0	0	0	0	0	0			
Subtotal SH-60B ACFT	163	170	168	168	164	158	152	132	112	92	72	52	32	12	0	0				
Less SH-60B Reman Inductions			-2		-4	-6	-6	-20	-20	-20	-20	-20	-20	-20	-12					
Total SH-60B ACFT	163	170	166	168	160	152	146	112	92	72	52	32	12	-8	-12	0	0	0	0	0
SH-60F																				
SH-60F ACFT																				
Less SH-60F Reman Inductions	0	0	0	0	0	0	0	9	9											
Total SH-60F ACFT	77	77	77	77	77	77	77	68	57	57	57	57	57	57	57	57	57	57	57	57
	0	0	0	0	0	0	0	68	59	57	57	57	57	57	57	57	57	57	57	57
SH-60R																				
SH-60B Reman Inductions	0	0	2	0	4	6	6	20	20	20	20	20	20	20	12					
SH-60F Reman Inductions	0	0	0	0	0	0	0	9	9											
SH-60R Inductions	0	0	2	0	4	6	6	29	29	20	20	20	20	20	12					
SH-60R Deliveries							4	15	15	19	21	20	20	20	20	20	14			
Total SH-60R ACFT							4	19	34	53	74	94	114	134	154	174	188	188	188	188
HH-60H																				
HH-60H Production Deliveries	13	11																		
Total HH-60H ACFT	31	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42
CH-60																				
CH-60 Production Deliveries	0	0	0	0	0	0	4	8	7	16	13	5	15	4	9	11	11	8	7	7
Total CH-60 ACFT	0	0	0	0	0	0	4	12	19	35	48	53	68	72	81	92	103	111	118	125
TOTAL USN H-60	271	289	285	287	279	271	273	253	244	259	273	278	293	297	322	365	390	398	405	412

Source: PMA-299 (29 Jan 1997)

Does Not include: HH-60J (USCG, 42 acft), Spanish (6 acft) or Taiwanize (9 acft) H-60's

APPENDIX D

SDLM DATA FILES

SDLMs Conducted by NADEP Pensacola - Original Data

	TMS	FY_ID	BUNO	FUND CODE	SUB	IJ	CJ	AD	WS	TOT_HRS	FPE	ME	DLC	MAT_COST	DOC	PE	GAE	OVERHEAD	NIF	STAT_TOTAL
1	SH60B	87	161553	1	36	6289	7100	176	7740	6745	532679	116035	114849	39604		82656	128015	210671	365124	410012
2	SH60B	88	161556	1	36	7028	7302	275	7150	8517	500920	116035	149350	45889		95706	159937	255643	450882	263350
3	SH60B	88	161557	1	36	7065	8043	343	6550	6859	468622	116035	116226	112606		76406	125107	201513	430345	0
4	SH60B	88	162095	1	36	7253	8138	251	5953	6690	436485	116035	116431	63730		75874	115970	191844	372005	0
5	SH60B	89	161559	1	36	7303	8274	337	5953	5192	354534	115700	91624	83833		57576	99887	157463	332920	0
6	SH60B	89	162106	1	36	8208	9048	207	5953	5532	354535	115700	98271	110319		80756	108577	189333	397923	32478
7	SH60B	89	162114	1	36	9019	9222	204	5953	4812	500855	262021	91991	301420		125436	33017	158453	551864	21812
8	SH60B	91	161554	1	36	283	1151	233	5658	5699	504647	270406	111983	354691		156263	51566	207829	674503	3790
9	SH60B	91	162093	1	36	19	1070	417	5658	6794	504647	270406	128912	316947		179389	57093	236482	682341	4190
10	SH60B	91	162098	1	36	163	1123	325	5658	7435	504647	270406	142624	284698		212092	67847	279939	707261	4678
11	SH60B	91	162099	1	36	1022	1235	214	5658	6586	738911	382570	132916	484328		183942	56331	240273	857517	4379
12	SH60B	91	162100	1	36	9349	269	287	5658	5262	504647	270406	101769	198850		132157	43288	175445	476064	3191
13	SH60B	91	162102	1	36	9304	1018	444	5658	6882	504647	270406	131592	418368		182677	60619	243296	793256	4421
14	SH60B	91	162103	1	36	274	1198	380	5658	6473	504647	270406	124905	354248		178452	59375	237827	716980	4305
15	SH60B	91	162109	1	36	9221	263	407	5953	6821	500855	262021	128148	130730		183518	50772	234290	493168	4176
16	SH60B	91	162111	1	36	85	320	235	5658	5931	504647	270406	112552	224481		156424	47890	204314	541347	3339
17	SH60B	91	162328	1	36	144	1025	145	5658	5778	504647	270406	111986	242950		164042	52485	216527	571463	5700
18	SH60B	92	161569	1	36	1120	1331	212	5658	5197	738911	382570	108898	191880		140189	42935	183124	483902	3456
19	SH60B	92	162094	1	36	1228	2087	226	5658	6608	738911	382570	134075	314385		181902	53765	235667	684127	2768
20	SH60B	92	162101	1	36	290	1297	373	5658	6357	504647	270406	127614	462663		174468	54918	229386	819663	4228
21	SH60B	92	162121	1	36	1190	2059	235	5658	5211	738911	382570	109309	112401		150197	41884	192081	413791	2736
22	SH60B	92	162122	1	36	1157	2038	247	5658	6208	738911	382570	128091	244502		175998	50204	226202	598795	3697
23	SH60B	92	162132	1	36	1063	1326	263	5658	5385	738911	382570	110948	404445		149825	46601	196426	711819	3559
24	SH60B	92	162135	1	36	1289	2169	246	5480	5491	699826	337105	116890	313311		129575	52812	182387	612588	877
25	SH60B	92	162156	1	36	1282	2143	226	5658	5794	738911	382570	121501	384502		140066	53716	193782	699785	1143
26	SH60B	92	162342	1	36	1253	2093	206	5658	5483	738911	382570	113464	245302		146554	46925	193479	552245	1956
27	SH60B	93	161564	1	36	2140	3025	250	5480	6965	699826	337105	151139	348529		141375	77876	219251	718919	7
28	SH60B	93	162107	1	36	1266	2174	274	5658	6402	738911	382570	135082	340298		150852	61171	212023	687403	1067
29	SH60B	93	162112	1	36	1296	2265	335	5480	7109	699826	337105	154645	475943		147423	72126	219549	850137	819
30	SH60B	93	162117	1	36	2258	3124	231	5480	6970	699826	337105	156070	482904		163480	93430	256910	895884	7
31	SH60B	93	162130	1	36	2086	2335	249	5480	6465	699826	337105	139536	515184		120398	68255	188653	843373	6
32	SH60B	93	162329	1	36	2043	2262	220	5480	6921	699826	337105	147450	502541		136972	69860	206832	856823	7
33	SH60B	93	162330	1	36	2078	3039	326	5480	8325	699826	337105	182550	583497		190468	96041	286509	1052556	7
34	SH60B	93	162333	1	36	2056	2297	241	5480	7561	699826	337105	166696	622648		148677	79953	228630	1017974	7
35	SH60B	93	162341	1	36	2273	3197	289	5480	6704	699826	337105	152814	628670		173091	88961	262052	1043536	6
36	SH60B	93	162347	1	36	2160	3126	331	5480	8301	699826	337105	182744	909813		206525	98908	305433	1397990	8
37	SH60B	93	163243	1	36	2267	3144	242	5480	7137	699826	337105	161449	476319		168900	100757	269657	907425	7
38	SH60B	94	161565	1	36	3132	4019	253	5804	7278	765133	378412	183172	631079		175881	111836	287717	1101968	6
39	SH60B	94	161566	1	36	3183	4153	336	5804	6520	765133	378412	154993	673141	54819	153878	109730	263608	1146561	0
40	SH60B	94	162124	1	36	2348	3300	318	5804	7466	765133	378412	175747	469723		197602	113333	310935	956405	7
41	SH60B	94	162133	1	36	3165	4096	297	5804	7566	765133	278412	186509	646154	14847	198155	125368	323523	1171033	0
42	SH60B	94	162134	1	36	3144	4049	271	5804	8152	765133	378412	211057	558728		210735	132511	343246	1113031	0
43	SH60B	94	162136	1	36	2302	3267	331	5804	7807	765133	378412	183228	593142		179516	114664	294180	1070550	7
44	SH60B	94	162332	1	36	2290	3242	317	5804	8920	765132	378412	205060	830974		215979	130626	346605	1382639	9
45	SH60B	94	162335	1	36	3312	4242	296	5368	7818	872389	509727	184943	732692	63836	198707	129464	328171	1309642	0
46	SH60B	94	162990	1	36	3050	3353	304	5804	8968	765133	378412	217048	692380		230992	125929	356921	1266349	7
47	SH60B	95	162095	1	36	3253	4298	411	5804	8898	765133	378412	212421	662050	23939	211251	147460	358711	1257121	34481
48	SH60B	95	162114	1	36	4068	5059	357	5368	7195	872389	509727	167404	622548	52810	186823	117459	304282	1147044	28018
49	SH60B	95	162120	1	36	3334	4298	330	5368	7291	872389	509727	172891	814224	42155	177403	120785	298188	1327458	28242
50	SH60B	95	162125	1	36	4216	5258	408	5368	5762	872389	509727	133683	431668	53852	131705	97220	228925	848129	22692
51	SH60B	95	162131	1	36	4082	5090	374	5368	6540	872389	509727	152277	789255	36114	160463	109037	269500	1247145	25626
52	SH60B	95	162327	1	36	3253	4298	411	5804	8520	765133	378412	200952	877482	40876	217725	140929	358654	1477964	32833
53	SH60B	95	162344	1	36	4039	4361	323	5368	7204	872389	509727	168020	1113255	39885	173613	119599	293212	1614372	27968

SH-60B SDLM COMPLETED BY CCAD

	"new"	BuNo	DLA Rec Date	Induct date	yrs to ind	Sked Compl	sell date	Prop TAT	ACT TAT	Wait
1	2/16/84	161558	5/30/95	7/12/95	11.408	5/30/97	5/1/97	688	659	43
2	10/7/85	162118	1/9/95	2/9/95	9.348	9/5/96	9/3/96	574	572	31
3	3/11/86	162126	4/12/95	4/28/95	9.137	1/21/97	1/21/97	634	634	16
4	1/25/91	162328	4/5/95	4/19/95	4.233	11/7/96	11/19/96	568	580	14
5	4/7/87	162340	2/15/95	3/8/95	7.923	10/1/96	9/28/96	573	570	21
6	7/20/87	162345	12/07/95	12/18/95	8.419	6/30/97	6/26/97	560	556	11
7	1/14/88	162981	4/18/95	6/19/95	7.433	1/17/97	1/17/97	578	578	62
8	4/13/89	163239	7/12/95	8/1/95	6.304	5/30/97	5/30/97	668	668	20

SH-60B SDLM IN WORK - CCAD

	"new"	BuNo	DLA Rec Date	Induct date	yrs to ind	Sked Compl	Prop TAT	Wait	
1	10/02/86	162137	5/20/94	12/07/94		12/31/97		201	CRASH DMG
2	09/21/83	161553	11/26/96	12/17/96	13.249	01/29/98	408	21	
3	09/28/84	161568	9/21/95	09/27/95	11.003	07/31/97	673	6	
4	04/03/85	162106	9/21/95	11/06/95	10.600	09/30/97	694	46	
5	04/19/85	162107	10/16/95	11/06/95	10.556	11/26/97	751	21	
6	10/07/85	162118	1/9/95	02/09/95	9.348	09/05/96	574	31	
7	07/08/87	162346	9/28/95	11/01/95	8.323	08/29/97	667	34	
8	06/10/88	162989	3/7/97	03/18/97	8.775	02/26/98	345	11	
9	12/16/88	163235	9/10/96	09/23/96	7.775	08/29/97	340	13	
10	12/20/88	163238	11/6/96	12/31/96	8.036	01/29/98	394	55	
11	04/13/89	163239	7/12/95	08/01/95	6.304	05/30/97	668	20	
12	05/24/93	163243	4/29/97	05/26/97	4.008	?		27	
13	06/19/89	163244	4/28/97	05/25/97	7.937	?		27	
14	09/18/89	163246	8/27/96	09/05/96	6.970	?		9	
15	01/08/90	163593	10/3/96	12/05/96	6.912	11/26/97	356	63	

SH-60B's with Two SDLMs

SDLM	"new"	Buno	Loc	Induct Date	yrs to induct	sked compl	ACT comp	sked TAT	Act Tat
1	12/20/84	162095	PCOLA	09/10/87	2.723		05/17/88		250
2	05/17/88	162095	PCOLA	09/10/93	5.321		10/25/94		410
1	09/05/85	162114	PCOLA	01/19/89	3.375		08/10/89		203
2	08/10/89	162114	PCOLA	03/09/94	4.581		02/28/95		356
1	09/21/83	161553	PCOLA	10/16/86	3.071		04/10/87		176
2	04/10/87	161553	CCAD	12/17/96	9.696	01/29/98		408	
1	04/03/85	162106	PCOLA	07/26/88	3.315		02/17/89		206
2	02/17/89	162106	CCAD	11/06/95	6.721	09/30/97		694	
1	04/19/85	162107	PCOLA	09/23/91	6.433		06/22/92		273
2	06/22/92	162107	CCAD	11/06/95	3.375	11/26/97		751	
1	10/30/86	162328	PCOLA	05/24/90	3.567		01/25/91		246
2	01/25/91	162328	CCAD	04/19/95	4.233	11/07/96	11/19/96		580
1	05/27/87	163243	PCOLA	09/23/92	5.332		05/24/93		243
2	05/24/93	163243	CCAD	05/26/97	4.008	?			

SH-60B PPR DATA USED FOR REGRESSION

FY_ID	BUNO	FRS Y=1	COAST W=1	"NEW" Day	Ind Day	Yrs to ind	Comp Day	TAT	Work Std	Total Hours	FPE97 (97$)	ME97 (97$)	DLC97 (97$)	MC (97$)	total DCs (97$)
87	161553	1	1	9/21/83	10/16/86	3.071	4/10/87	176	7740	6745	$707,597	$154,138	$152,562	$52,609	$205,171
88	161556	1	1	12/8/83	1/28/87	3.142	10/29/87	274	7150	8517	$648,021	$150,110	$193,208	$59,365	$252,573
88	161557	1	1	1/17/84	3/6/87	3.134	2/12/88	343	6550	6859	$606,238	$150,110	$150,357	$145,674	$296,031
88	162095	0	0	12/20/84	9/10/87	2.723	5/17/88	250	5953	6690	$564,664	$150,110	$150,622	$82,445	$233,067
89	161559	1	1	3/15/84	10/30/87	3.627	9/30/88	336	5953	5192	$441,347	$144,031	$114,060	$104,361	$218,420
89	162106	0	0	4/3/85	7/26/88	3.315	2/17/89	206	5953	5532	$441,348	$144,031	$122,334	$137,332	$259,666
89	162114	0	0	9/5/85	1/19/89	3.375	8/10/89	203	5953	4812	$623,497	$326,181	$114,516	$375,227	$489,744
91	161554	1	1	11/9/83	10/10/90	6.923	5/31/91	233	5658	5699	$580,922	$311,277	$128,909	$408,301	$537,210
91	162093	0	0	12/7/84	1/19/90	5.121	3/11/91	416	5658	6794	$580,922	$311,277	$148,396	$364,852	$513,249
91	162098	0	0	12/27/84	6/12/90	5.460	5/3/91	325	5658	7435	$580,922	$311,277	$164,181	$327,729	$491,910
91	162099	0	0	12/7/84	1/22/91	6.129	8/23/91	213	5658	6586	$850,594	$440,394	$153,006	$557,532	$710,538
91	162100	0	1	2/21/84	12/15/89	5.819	9/26/90	285	5658	5262	$580,922	$311,277	$117,151	$228,905	$346,056
91	162102	0	1	3/18/85	10/31/89	4.625	1/18/91	444	5658	6882	$580,922	$311,277	$151,482	$481,602	$633,084
91	162103	0	1	2/19/85	10/1/90	5.616	7/17/91	289	5658	6473	$580,922	$311,277	$143,784	$407,791	$551,575
91	162109	0	1	5/30/85	8/9/89	4.197	9/20/90	407	5953	6821	$576,557	$301,624	$147,517	$150,489	$298,006
91	162111	0	1	8/12/85	3/26/90	4.622	11/16/90	235	5658	5931	$580,922	$311,277	$129,564	$258,410	$387,974
91	162328	0	0	10/30/86	5/24/90	3.567	1/25/91	246	5658	5778	$580,922	$311,277	$128,912	$279,671	$408,583
92	161569	1	1	9/13/84	4/30/91	6.630	11/27/91	211	5658	5197	$822,291	$425,740	$121,186	$213,532	$334,718
92	162094	0	1	12/7/84	8/16/91	6.693	3/27/92	224	5658	6608	$822,291	$425,740	$149,204	$349,861	$499,065
92	162101	0	0	2/8/85	10/17/90	5.690	10/24/91	372	5658	6357	$561,592	$300,919	$142,014	$514,871	$656,885
92	162121	1	0	10/31/85	7/9/91	5.690	2/28/92	234	5658	5211	$822,291	$425,740	$121,644	$125,085	$246,728
92	162122	0	0	11/21/85	6/6/91	5.542	2/7/92	246	5658	6208	$822,291	$425,740	$142,545	$272,092	$414,637
92	162132	0	0	5/21/86	3/4/91	4.789	11/22/91	263	5658	5385	$822,291	$425,740	$123,468	$450,083	$573,551
92	162135	1	1	8/19/86	10/16/91	5.162	6/17/92	245	5480	5491	$778,796	$375,145	$130,080	$348,666	$478,746
92	162116	1	0	9/5/85	10/9/91	6.096	5/22/92	226	5658	5794	$822,291	$425,740	$135,211	$427,890	$563,101
92	162342	0	0	5/7/87	9/10/91	4.348	4/2/92	205	5658	5483	$822,291	$425,740	$126,268	$272,982	$399,250
93	161564	1	1	6/28/84	5/19/92	7.896	1/25/93	251	5480	6965	$754,367	$363,377	$162,918	$375,691	$538,609
93	162107	0	0	4/19/85	9/23/91	6.433	6/22/92	273	5658	6402	$796,498	$412,385	$145,610	$366,819	$512,429
93	162112	0	1	8/14/85	10/23/91	6.195	9/21/92	334	5480	7109	$754,367	$363,377	$166,697	$513,035	$679,733
93	162117	0	1	12/4/85	9/14/92	6.784	5/4/93	232	5480	6970	$754,367	$363,377	$168,233	$520,539	$688,772
93	162130	0	0	5/9/86	3/26/92	5.885	11/30/92	249	5480	6465	$754,367	$363,377	$150,411	$555,335	$705,745
93	162329	0	1	10/9/86	2/12/92	5.348	9/18/92	219	5480	6921	$754,367	$363,377	$158,941	$541,706	$700,648
93	162330	0	0	10/29/86	3/18/92	5.389	2/8/93	327	5480	8325	$754,367	$363,377	$196,777	$628,972	$825,749
93	162333	0	0	12/16/86	2/25/92	5.197	10/23/92	241	5480	7561	$754,367	$363,377	$179,687	$671,174	$850,861
93	162341	0	0	8/3/87	9/29/92	5.162	7/16/93	290	5480	6704	$754,367	$363,377	$164,724	$677,665	$842,389
93	162347	0	1	9/10/87	6/8/92	4.748	5/6/93	332	5480	8301	$754,367	$363,377	$196,986	$980,719	$1,177,705
93	163243	0	1	6/30/89	9/23/92	3.236	5/24/93	243	5480	7137	$754,367	$363,377	$174,031	$513,441	$687,472
94	161565	1	0	6/11/84	5/12/93	8.923	1/19/94	252	5804	7278	$812,847	$402,010	$194,595	$670,433	$865,028
94	161566	1	1	7/13/84	7/2/93	8.975	6/2/94	335	5804	6520	$812,847	$402,010	$164,658	$715,118	$879,777
94	162124	1	0	3/11/86	12/13/92	6.764	10/27/93	318	5804	7466	$812,847	$402,010	$186,707	$499,015	$685,722
94	162133	1	1	8/19/86	6/14/93	6.825	4/5/94	295	5804	7566	$812,847	$295,774	$198,140	$686,449	$884,588
94	162134	0	1	5/21/86	5/24/93	7.014	2/18/94	270	5804	8152	$812,847	$402,010	$224,219	$593,571	$817,789
94	162136	0	0	7/16/86	10/28/92	6.290	9/24/93	331	5804	7807	$812,847	$402,010	$194,654	$630,131	$824,785
94	162332	0	1	5/27/87	10/16/92	5.395	8/30/93	318	5804	8920	$812,846	$402,010	$217,848	$882,794	$1,100,642
94	162335	0	0	3/13/87	11/8/93	6.663	8/30/94	295	5368	7818	$926,792	$541,514	$196,476	$778,383	$974,859
94	162990	0	1	9/6/88	2/19/93	4.458	12/19/93	303	5804	8968	$812,847	$402,010	$230,583	$735,557	$966,140
95	162120	0	0	12/4/85	11/30/93	7.995	10/25/94	329	5368	7291	$911,111	$532,352	$180,565	$850,364	$1,030,930
95	162125	1	1	1/24/86	8/4/94	8.532	9/15/95	407	5368	5762	$911,111	$532,352	$139,617	$450,828	$590,445
95	162131	1	0	7/9/86	3/23/94	7.710	3/31/95	373	5368	6540	$911,111	$532,352	$159,036	$824,287	$983,323
95	162327	0	1	12/5/86	9/10/93	6.770	10/25/94	410	5804	8520	$799,095	$395,208	$209,872	$916,430	$1,126,302
95	162344	1	1	8/7/87	2/8/94	6.512	12/27/94	322	5368	7204	$911,111	$532,352	$175,478	$1,162,668	$1,338,146

APPENDIX E
PRODUCTION PRODUCTIVITY REPORTS

Production Productivity Reports (PPRs) are prepared each quarter by each individual NADEP. The PPR provides information, by individual aircraft bureau number, relating to induction date, days in process, completion date, hours expended, and various cost reporting categories. It contains sufficient detail to examine costs per aircraft in a true chronological perspective. The same T/M/S aircraft were evaluated using this database. Data were extracted from sub-program code categories (36) SDLM and (41) Airframe Change - SDLM. Key cost fields used in this study are described below:

Induction Julian Date (IJ) - self explanatory.

Completion Julian Date (CJ) - self explanatory.

Turnaround Time (AD) - actual days in work.

Work Standard (WS) - projected work scope (hours) based on specification.

Total Direct Labor Hours (TOT_HRS) represents the actual direct civilian man hours incurred to rework each completed aircraft.

Fixed Price Standard (FPE) represents the anticipated total costs for the SDLM.

Material Standard (ME) represents the anticipated costs for raw materials, components and kits incurred by the NADEP.

Direct Labor Cost (DLC) represents the dollar cost of the actual direct civilian man hours incurred to rework each completed aircraft.

Direct Material Cost (MAT_COST) represents the direct costs for raw materials, components and kits incurred by the NADEP. Since 1989 this category has included Government Furnished Equipment (GFM) that was previously considered a statistical cost.

Other Direct Costs (DOC) represents direct costs other than labor and rework material.

Production Expense Overhead (PE) represents the production overhead expenses at the NADEP.

General and Administrative (GAE) represents general and administrative (G&A) expenses at the NADEP.

Total Overhead (OVERHEAD) is the sum of production overhead expense and general and administrative (G&A) expenses at the NADEP.

NIF Total Cost (NIF) represents "actual cost charged" by the NADEP. It is the sum of including direct labor hours times cost of that effort, direct material, and total overhead applied (DLC+MAT_COST+OVERHEAD).

Statistical Cost (STAT_TOTAL) represents total costs associated with military labor, which is generally insignificant, and GFM. This cost element tended to fluctuate widely by individual job until 1989 when all GFM was added to the Direct Material Cost category.

Raw PPR data (code 36) is contained in Appendix D.

APPENDIX F - ASPA DATA

TMS	BUNO	ASPA	PED	LOT	TOUR	P/F	FLT HRS	REPORT	DEPOT	UNIT	
HH-60H	163783	1		I	1	P					*
HH-60H	163783	2	5/96	I	1	P		27-Jan-95	NORIS	RWTESTRON	
HH-60H	163783	3	5/97	I	1	P	1281.5	20-Dec-95	CHPT	RWTESTRON	
HH-60H	163783	4	7/98	I	1	P	1421.7	1-Jul-97	CHPT	RWTESTRON	
HH-60H	163784	1		I	1	P					*
HH-60H	163784	2		I	1	P					*
HH-60H	163784	3		I	1	P					*
HH-60H	163784	4		I	1	P					*
HH-60H	163784	5	10/96	I	1	P	2329.4	16-May-96	NORIS	HCS-5	
HH-60H	163785	1		I	1	P					*
HH-60H	163785	1		I	1	P					*
HH-60H	163785	2		I	1	P					*
HH-60H	163785	2		I	1	P					*
HH-60H	163785	3		I	1	P					*
HH-60H	163785	3		I	1	P					*
HH-60H	163785	4	7/96	I	1	P	2593.7	21-Feb-96	NORIS	HCS-5	
HH-60H	163785	4		I	1	P					*
HH-60H	163785	5		I	1	P					*
HH-60H	163785	6	7/98	I	1	P	2785.2	11-Feb-97	NORIS	HCS-5	
HH-60H	163786	1		I	1	P					*
HH-60H	163786	2	4/95	I	1	P		2-May-94	PNCLA	HCS-4	
HH-60H	163786	3	4/96	I	1	P		14-Dec-94	CHPT	HCS-4	
HH-60H	163786	4	4/97	I	1	P		24-Jan-96	CHPT	HCS-4	
HH-60H	163786	5	4/98	I	1	P		4-Dec-96	CHPT	HCS-4	
HH-60H	163787	1		I	1	P					*
HH-60H	163787	2		I	1	P					*
HH-60H	163787	3	6/95	I	1	P	1659.8	13-Jan-95	CHPT	HCS-4	
HH-60H	163787	4	6/97	I	1	P	2090.9	4-Apr-96	CHPT	HCS-4	
HH-60H	163788	1		I	1	P					*
HH-60H	163788	2		I	1	P					*
HH-60H	163788	3		I	1	P					*
HH-60H	163788	4	12/95	I	1	P	2474.9	28-Sep-95	NORIS	HCS-5	
HH-60H	163788	5	2/97	I	1	P	2768.5	26-Sep-96	NORIS	HCS-5	
HH-60H	163789	1		I	1	P					*
HH-60H	163789	2		I	1	P					*
HH-60H	163789	3		I	1	P					*
HH-60H	163789	4	4/96	I	1	F	2236.0	12-Dec-95	NORIS	HCS-5	
HH-60H	163790	1		II	1	P					*
HH-60H	163790	2	6/95	II	1	P		12-Feb-94	PNCLA	HCS-4	
HH-60H	163790	3	6/96	II	1	P	2351.4	20-Mar-95	CHPT	HCS-4	
HH-60H	163790	4	6/97	II	1	P		19-Mar-96	CHPT	HCS-4	
HH-60H	163791	1		II	1	P					*
HH-60H	163791	2		II	1	P					*
HH-60H	163791	3	5/96	II	1	P	2355.6	16-Dec-94	CHPT	HCS-4	
HH-60H	163791	4	5/97	II	1	P		10-Jan-96	CHPT	HCS-4	
HH-60H	163792	1		II	1	P					*
HH-60H	163792	2	11/95	II	1	P	2843.9	20-Sep-94	NAPRA	HS-2	
HH-60H	163792	3	11/96	II	1	P	3402.7	8-Nov-95	NORIS	HS-2	
HH-60H	163792	4	11/96	II	1	F	3716.7	27-Jun-96	NORIS	HS-8	
HH-60H	163794	1		III	1	P					*
HH-60H	163794	2	12/95	III	1	P	2210.8	5-Jan-95	CHPT	HS-11	
HH-60H	163794	3	12/96	III	1	P		12-Mar-96	CHPT	HS-11	
HH-60H	163794	4	12/97	III	1	P	2888.0	19-Jul-96	CHPT	HS-11	
HH-60H	163795	1		III	1	P					*
HH-60H	163795	2	2/96	III	1	P	2521.3	3-Jan-95	CHPT	HS-3	
HH-60H	163795	3	2/97	III	1	P		24-Oct-95	CHPT	HS-3	
HH-60H	163795	4	2/97	III	1	F		24-Jan-97	CHPT	HS-3	

TMS	BUNO	ASPA	PED	LOT	TOUR	P/F	FLT HRS	REPORT	DEPOT	UNIT	
HH-60H	163796	1		III	1	P					*
HH-60H	163796	2	5/96	III	1	P	1756.5	11-Jan-95	CHPT	HCS-4	
HH-60H	163796	3	5/97	III	1	P		7-Feb-96	CHPT	HCS-4	
HH-60H	163796	4	6/98	III	1	P		3-Dec-96	CHPT	HCS-4	
HH-60H	163797	1		III	1	P					*
HH-60H	163797	2	5/96	III	1	P	1552.7	20-Dec-94	CHPT	HCS-4	
HH-60H	163797	3	5/97	III	1	P	1896.1	22-May-96	CHPT	HCS-4	
HH-60H	163798	1		III	1	P					*
HH-60H	163798	2	10/97	III	1	P	1543.9	20-Apr-96	NORIS	HCS-5	
HH-60H	163798	3	9/98	III	1	P	1809.6	3-Apr-97	NORIS	HCS-5	
HH-60H	163799	1		III	1	P					*
HH-60H	163799	2	7/96	III	1	P	1496.1	8-Feb-95	CHPT	HCS-4	
HH-60H	163799	3		III	1	P					*
HH-60H	163799	4	7/98	III	1	P		5-Feb-97	CHPT	HCS-4	
HH-60H	163800	1		III	1	P					*
HH-60H	163800	2	8/95	III	1	P	1434.5	19-Apr-95	NORIS	HCS-5	
HH-60H	163800	3	8/96	III	1	P	1768.8	19-Apr-96	NORIS	HCS-5	
HH-60H	163800	4	8/97	III	1	P	1952.6	20-Mar-97	NORIS	HCS-5	
NSH-60B	162337	1	10/95	IV	1	P		21-Nov-95	CHPT	RWTESTRON	
NSH-60B	162337	2	5/98	IV	1	P	665.9	16-Jan-97	CHPT	RWTESTRON	
NSH-60B	162974	1		V	1	P					*
NSH-60B	162974	2		V	1	P					*
NSH-60B	162974	3		V	1	P					*
NSH-60B	162974	4		V	1	P					*
NSH-60B	162974	5	7/96	V	1	P		4-Oct-95	CHPT	USNTPS	
NSH-60B	162974	6	7/97	V	1	P	1826.2	28-Aug-96	CHPT	USNTPS	
NSH-60B	162974	7	7/98	V	1	P	1956.8	2-Jul-97	CHPT	USNTPS	
SH-60B	161553	1		I	2	P					*
SH-60B	161553	2	10/95	I	2	P		13-Oct-94	NORIS	HSL-41	
SH-60B	161553	3	2/96	I	2	P		2-Feb-95	NORIS	HSL-41	
SH-60B	161554	1		I	2	P					*
SH-60B	161554	2		I	2	P					*
SH-60B	161554	3	6/97	I	2	P		4-Jun-96	NORIS	HSL-45	
SH-60B	161554	4	6/97	I	2	F	7491.0	5-Jun-97	NORIS	HSL-45	
SH-60B	161555	1		I	1	P					*
SH-60B	161555	2		I	1	P					*
SH-60B	161555	3		I	1	P					*
SH-60B	161555	4		I	1	P					*
SH-60B	161555	5		I	1	P					*
SH-60B	161555	6	4/95	I	1	F	4904.4	7-Mar-95	NORIS	HSL-41	
SH-60B	161556	1		I	2	P					*
SH-60B	161556	2		I	2	P					*
SH-60B	161556	3		I	2	P					*
SH-60B	161556	4	11/95	I	2	P	4228.8	1-Nov-94	NORIS	HSL-41	
SH-60B	161556	5	11/96	I	2	P	4702.0	20-Nov-95	NORIS	HSL-41	
SH-60B	161556	6	11/97	I	2	P	5276.3	15-Jul-96	NORIS	HSL-41	
SH-60B	161556	7	11/98	I	2	P		13-Aug-97	NORIS	HSL-41	
SH-60B	161558	1		I	1	P					*
SH-60B	161558	2		I	1	P					*
SH-60B	161558	3		I	1	P					*
SH-60B	161558	4		I	1	P					*
SH-60B	161558	5		I	1	P					*
SH-60B	161558	6		I	1	P					*
SH-60B	161558	7	2/95	I	1	F		27-Mar-95	NORIS	HSL-47	
SH-60B	161559	1		I	2	P					*
SH-60B	161559	2		I	2	P					*
SH-60B	161559	3		I	2	P					*

TMS	BUNO	ASPA	PED	LOT	TOUR	P/F	FLT HRS	REPORT	DEPOT	UNIT	
SH-60B	161559	4	4/96	I	2	P	4665.8	4-Apr-95	NORIS	HSL-41	
SH-60B	161559	5	4/97	I	2	P		7-Jan-96	NORIS	HSL-41	
SH-60B	161559	6	4/97	I	2	F	5769.6	10-Apr-97	NORIS	HSL-41	
SH-60B	161560	1		I	1	P					*
SH-60B	161560	2		I	1	P					*
SH-60B	161560	3		I	1	P					*
SH-60B	161560	4		I	1	P					*
SH-60B	161560	5	6/96	I	1	P	2917.8	19-Jun-95	NORIS	HSL-41	
SH-60B	161560	6	6/97	I	1	P	3330.4	13-Mar-96	NORIS	HSL-41	
SH-60B	161560	7	6/98	I	1	P		9-Jun-97	NORIS	HSL-41	
SH-60B	161561	1		I	1	P					*
SH-60B	161561	2		I	1	P					*
SH-60B	161561	3		I	1	P					*
SH-60B	161561	4		I	1	P					*
SH-60B	161561	5	4/95	I	1	P		7-Jun-94	PNCLA	VX-1	
SH-60B	161561	6	4/96	I	1	P		10-Apr-95	CHPT	HSL-40	
SH-60B	161561	7	4/97	I	1	P	2815.2	27-Feb-96	CHPT	HSL-40	
SH-60B	161561	8	4/98	I	1	P	3468.4	13-Mar-97	CHPT	HSL-40	
SH-60B	161562	1	5/96	I	2	P		18-Jan-95	NORIS	HSL-49	
SH-60B	161562	2	5/97	I	2	P	6060	2-Feb-96	NORIS	HSL-49	
SH-60B	161562	3	5/98	I	2	P	6567.9	20-Feb-97	NORIS	HSL-49	
SH-60B	161563	1		I	2	P					*
SH-60B	161563	2	10/95	I	2	P	4375.3	12-Oct-94	NORIS	HSL-41	
SH-60B	161563	3	10/95	I	2	P	4479.3	27-Jun-95	NORIS	HSL-41	
SH-60B	161563	4	10/97	I	2	P	5283.7	6-Aug-96	NORIS	HSL-41	
SH-60B	161567	1		I	1	P					*
SH-60B	161567	2		I	1	P					*
SH-60B	161567	3		I	1	P					*
SH-60B	161567	4		I	1	P					*
SH-60B	161567	5		I	1	P					*
SH-60B	161567	6	8/94	I	1	F		8-Jun-94	NORIS	HSL-49	
SH-60B	161568	1		I	1	P					*
SH-60B	161568	2		I	1	P					*
SH-60B	161568	3		I	1	P					*
SH-60B	161568	4		I	1	P					*
SH-60B	161568	5		I	1	P					*
SH-60B	161568	6		I	1	P					*
SH-60B	161568	7	6/95	I	1	F	5367.1	15-Jun-95	NORIS	HSL-41	
SH-60B	161569	1		I	2	P					*
SH-60B	161569	2	12/96	I	2	P	5250.6	29-Nov-95	NORIS	HSL-37	
SH-60B	161569	3	12/97	I	2	P	5548.2	22-Aug-96	NORIS	HSL-37	
SH-60B	161570	1		I	2	P					*
SH-60B	161570	2	10/95	I	2	P	4800.6	12-Oct-94	NORIS	HSL-41	
SH-60B	161570	3	10/96	I	2	P	5398.5	16-Oct-95	NORIS	HSL-41	
SH-60B	161570	4	10/97	I	2	P	6186.2	9-Sep-96	NORIS	HSL-41	
SH-60B	162093	1		II	2	P					*
SH-60B	162093	2	6/96	II	2	P		19-Jan-95	NORIS	HSL-49	
SH-60B	162093	3	6/97	II	2	P	7234.2	6-Mar-96	NORIS	HSL-49	
SH-60B	162093	4	6/98	II	2	P	7991.4	2-May-97	NORIS	HSL-49	
SH-60B	162094	1	3/94	II	2	F	7006.7	8-Nov-94	NORIS	HSL-49	
SH-60B	162094	1		II	3	P					*
SH-60B	162094	2	3/96	II	3	P	7597.2	10-Jan-96	NORIS	HSL-49	
SH-60B	162095	1	6/98	II	3	P		25-Apr-97	CHPT	HSL-40	
SH-60B	162096	1		II	2	P					*
SH-60B	162096	2	10/95	II	2	P	2642.1	15-Nov-94	CHPT	HSL-42	
SH-60B	162096	3	10/96	II	2	P		***	CHPT	HSL-42	
SH-60B	162096	4	10/97	II	2	P		5-Dec-96	CHPT	HSL-42	

TMS	BUNO	ASPA	PED	LOT	TOUR	P/F	FLT HRS	REPORT	DEPOT	UNIT	
SH-60B	162098	1		II	2	P					*
SH-60B	162098	2	5/95	II	2	F		4-May-95	NORIS	HSL-47	
SH-60B	162099	1	9/95	II	2	P		24-Aug-94	PNCLA	HSL-48	
SH-60B	162099	2	9/96	II	2	P		15-May-95	CHPT	HSL-48	
SH-60B	162099	3	9/97	II	2	P	6994.4	7-May-96	CHPT	HSL-48	
SH-60B	162100	1		II	2	P					*
SH-60B	162100	2	5/96	II	2	P	2321.9	16-Feb-95	CHPT	HSL-48	
SH-60B	162100	3	5/97	II	2	P	6343.8	27-Mar-96	CHPT	HSL-48	
SH-60B	162100	4	5/98	II	2	P		8-Jan-97	CHPT	HSL-48	
SH-60B	162101	1	11/95	II	2	P	5879.9	14-Oct-94	CHPT	HSL-42	
SH-60B	162101	2	11/96	II	2	P		25-May-95	CHPT	HSL-42	
SH-60B	162101	3	11/97	II	2	P		3-Oct-96	CHPT	HSL-42	
SH-60B	162102	1		II	2	P					*
SH-60B	162102	2		II	2	P					*
SH-60B	162102	3	2/96	II	2	P	6453.2	30-Nov-95	NORIS	HSL-37	
SH-60B	162102	4	2/97	II	2	F	7311.6	13-Mar-97	NORIS	HSL-37	
SH-60B	162103	1	7/95	II	2	P		28-Jul-94	NAPRA	HSL-51	
SH-60B	162103	2	7/96	II	2	P	6032	18-May-95	NAPRA	HSL-51	
SH-60B	162103	3	7/97	II	2	F	6483.3	21-Jun-96	NAPRA	HSL-51	
SH-60B	162104	1		II	2	P					*
SH-60B	162104	2		II	2	P					*
SH-60B	162104	3	11/96	II	2	P	5456.6	14-Nov-95	CHPT	HSL-42	
SH-60B	162104	4	11/97	II	2	P	5493.8	6-Jun-96	CHPT	HSL-42	
SH-60B	162105	1		II	2	P					*
SH-60B	162105	2		II	2	P					*
SH-60B	162105	3		II	2	P					*
SH-60B	162105	4	4/96	II	2	F	7373.8	25-Apr-96	NORIS	HSL-47	
SH-60B	162106	1		II	2	P					*
SH-60B	162106	2		II	2	P					*
SH-60B	162106	3		II	2	P					*
SH-60B	162106	4	7/95	II	2	F		27-Jul-95	CHPT	HSL-42	
SH-60B	162107	1	7/95	II	2	F		10-May-95	JAX	HSL-44	
SH-60B	162111	1		II	2	P					*
SH-60B	162111	2	12/95	II	2	P	6958.1	18-Oct-94	CHPT	HSL-42	
SH-60B	162111	3	12/96	II	2	P	8026.7	19-Dec-95	CHPT	HSL-42	
SH-60B	162111	4	12/97	II	2	P		8-Nov-96	CHPT	HSL-42	
SH-60B	162111	5	12/98	II	2	P		6-Aug-97	CHPT	HSL-40	
SH-60B	162112	1	9/95	II	2	P	6513.2	19-Sep-95	NAPRA	HSL-51	
SH-60B	162112	2	9/96	II	2	F		29-Aug-96	NAPRA	HSL-51	
SH-60B	162114	1		II	2	P					*
SH-60B	162114	2	3/94	II	2	F		2-Mar-94	PNCLA	HSL-40	
SH-60B	162115	1		II	1	P					*
SH-60B	162115	2		II	1	P					*
SH-60B	162115	3		II	1	P					*
SH-60B	162115	4		II	1	P					*
SH-60B	162115	5	3/95	II	1	P		4-Mar-94	PNCLA	HSL-40	
SH-60B	162115	6	3/96	II	1	P		17-Mar-95	CHPT	HSL-40	
SH-60B	162116	1		II	1	P					*
SH-60B	162116	2		II	1	P					*
SH-60B	162116	3		II	1	P					*
SH-60B	162116	4		II	1	P					*
SH-60B	162116	5		II	1	P					*
SH-60B	162116	6	8/95	II	1	P		19-Aug-94	PNCLA	HSL-40	
SH-60B	162117	1	5/98	II	2	P	7119.6	14-Feb-97	NORIS	HSL-49	
SH-60B	162119	1		III	1	P					*
SH-60B	162119	2		III	1	P					*
SH-60B	162119	3		III	1	P					*

TMS	BUNO	ASPA	PED	LOT	TOUR	P/F	FLT HRS	REPORT	DEPOT	UNIT	
SH-60B	162119	4		III	1	P					*
SH-60B	162119	5		III	1	P					*
SH-60B	162119	6	11/95	III	1	P		15-Nov-94	NORIS	HSL-43	
SH-60B	162119	7	11/95	III	1	F	6429.3	13-Oct-95	NORIS	HSL-43	
SH-60B	162121	1	3/96	III	2	P		8-Feb-95	CHPT	HSL-40	
SH-60B	162121	2	3/97	III	2	P	4897.5	8-Feb-96	CHPT	HSL-40	
SH-60B	162121	3	3/98	III	2	P		24-Jan-97	CHPT	HSL-40	
SH-60B	162122	1	2/96	III	2	P	7146.9	25-Oct-94	CHPT	HSL-42	
SH-60B	162122	2	2/97	III	2	P	7818.8	16-Jan-96	CHPT	HSL-42	
SH-60B	162122	3	2/98	III	2	P		29-May-97	CHPT	HSL-42	
SH-60B	162123	4	8/97	III	2	P	6278.1	16-Jul-96	CHPT	HSL-42	
SH-60B	162124	1	10/97	III	2	P		14-Nov-96	CHPT	HSL-40	
SH-60B	162126	1		III	1	P					*
SH-60B	162126	2		III	1	P					*
SH-60B	162126	3		III	1	P					*
SH-60B	162126	4		III	1	P					*
SH-60B	162126	5	3/95	III	1	P		7-Mar-94	PNCLA	HSL-44	
SH-60B	162126	6	3/95	III	1	F		3-Mar-95	CHPT	HSL-44	
SH-60B	162127	1		III	1	P					*
SH-60B	162127	2		III	1	P					*
SH-60B	162127	3		III	1	P					*
SH-60B	162127	4		III	1	P					*
SH-60B	162127	5		III	1	P					*
SH-60B	162127	6	12/94	III	1	F	3757.1	2-Nov-94	CHPT	HSL-40	
SH-60B	162128	1		III	1	P					*
SH-60B	162128	2		III	1	P					*
SH-60B	162128	3		III	1	P					*
SH-60B	162128	4		III	1	P					*
SH-60B	162128	5	9/95	III	1	P		20-Jul-95	CHPT	HSL-40	
SH-60B	162128	6	9/96	III	1	F		19-Nov-96	CHPT	HSL-40	
SH-60B	162129	1		III	1	P					*
SH-60B	162129	2		III	1	P					*
SH-60B	162129	3		III	1	P					*
SH-60B	162129	4		III	1	P					*
SH-60B	162129	5	5/95	III	1	P		20-May-94	PNCLA	HSL-40	
SH-60B	162129	6	5/96	III	1	P		21-Apr-95	CHPT	HSL-40	
SH-60B	162130	1	12/96	III	2	P	5361.6	14-Dec-95	CHPT	HSL-48	
SH-60B	162130	2	12/97	III	2	P	5753.0	18-Jul-96	CHPT	HSL-48	
SH-60B	162130	3	12/98	III	2	P		5-Aug-97	CHPT	HSL-48	
SH-60B	162131	1		III	1	P					*
SH-60B	162131	2		III	1	P					*
SH-60B	162131	3		III	1	P					*
SH-60B	162131	4		III	1	P					*
SH-60B	162131	5	7/94	III	1	F		3-Mar-94	PNCLA	HSL-42	
SH-60B	162132	1	11/95	III	2	P	4728.8	27-Jul-94	PNCLA	HSL-44	
SH-60B	162132	2	11/96	III	2	P	5676.8	28-Sep-95	CHPT	HSL-44	
SH-60B	162132	3	11/98	III	2	P		17-Jan-97	CHPT	HSL-44	
SH-60B	162133	1	4/98	III	2	P		24-Jul-97	CHPT	HSL-42	
SH-60B	162135	1	6/96	III	2	P		8-Aug-95	CHPT	HSL-44	
SH-60B	162135	2	6/97	III	2	P		24-Jun-96	CHPT	HSL-44	
SH-60B	162136	1	9/97	III	2	P	6402.1	5-Sep-96	CHPT	HSL-44	
SH-60B	162139	1		III	1	P					*
SH-60B	162139	2		III	1	P					*
SH-60B	162139	3		III	1	P					*
SH-60B	162139	4		III	1	P					*
SH-60B	162139	5		III	1	P					*
SH-60B	162139	6	10/96	III	1	P	4291.5	26-Oct-95	CHPT	HSL-40	

TMS	BUNO	ASPA	PED	LOT	TOUR	P/F	FLT HRS	REPORT	DEPOT	UNIT	
SH-60B	162139	7	10/97	III	1	P		2-Oct-96	CHPT	HSL-40	
SH-60B	162326	1		IV	1	P					*
SH-60B	162326	2		IV	1	P					*
SH-60B	162326	3		IV	1	P					*
SH-60B	162326	4	11/95	IV	1	P		24-Jan-96	CHPT	RWTESTRON	
SH-60B	162326	5	11/97	IV	1	P		30-Jul-96	CHPT	RWTESTRON	
SH-60B	162328	1		IV	2	P					*
SH-60B	162328	2	3/95	IV	2	F	3108.6	19-Jan-95	CHPT	HSL-46	
SH-60B	162329	1	9/96	IV	2	P	6116.7	24-May-95	NAPRA	HSL-51	
SH-60B	162329	2	9/97	IV	2	P	6766.5	23-Sep-96	NAPRA	HSL-51	
SH-60B	162329	3	9/98	IV	2	P		29-May-97	NAPRA	HSL-51	
SH-60B	162333	1	10/96	IV	2	P	6339.5	26-Sep-95	CHPT	HSL-46	
SH-60B	162333	2	10/97	IV	2	P	6794.5	14-Sep-96	CHPT	HSL-46	
SH-60B	162334	1		IV	1	P					*
SH-60B	162334	2		IV	1	P					*
SH-60B	162334	3		IV	1	P					*
SH-60B	162334	4		IV	1	P					*
SH-60B	162334	5		IV	1	P					*
SH-60B	162334	6	11/95	IV	1	F		30-Nov-95	CHPT	HSL-44	
SH-60B	162335	1	8/97	IV	2	P	7525.8	10-Mar-97	CHPT	HSL-48	
SH-60B	162336	1		IV	1	P					*
SH-60B	162336	2		IV	1	P					*
SH-60B	162336	3		IV	1	P					*
SH-60B	162336	4		IV	1	P					*
SH-60B	162336	5	11/95	IV	1	P	5056.0	2-Aug-94	NORIS	HSL-47	
SH-60B	162336	6	11/95	IV	1	F	5902.8	3-Nov-95	NORIS	HSL-47	
SH-60B	162339	1		IV	1	P					*
SH-60B	162339	2		IV	1	P					*
SH-60B	162339	3		IV	1	P					*
SH-60B	162339	4		IV	1	P					*
SH-60B	162339	5	9/94	IV	1	F	5871.5	26-Oct-94	NAPRA	HSL-51	
SH-60B	162340	1		IV	1	P					*
SH-60B	162340	2		IV	1	P					*
SH-60B	162340	3		IV	1	P					*
SH-60B	162340	4	1/95	IV	1	F	6401.4	12-Dec-94	CHPT	HSL-44	
SH-60B	162341	1	7/98	IV	2	P	6728.8	2-Jun-97	NORIS	HSL-37	
SH-60B	162342	1	4/96	IV	2	P	1682.1	7-Mar-95	CHPT	HSL-44	
SH-60B	162342	2	4/98	IV	2	P	5699.0	29-Mar-96	CHPT	HSL-44	
SH-60B	162342	3	4/98	IV	2	P	6936.8	28-Feb-97	CHPT	HSL-44	
SH-60B	162345	1		IV	1	P					*
SH-60B	162345	2		IV	1	P					*
SH-60B	162345	3		IV	1	P					*
SH-60B	162345	4		IV	1	P					*
SH-60B	162345	5	9/95	IV	1	P	5621.0	19-Sep-94	NORIS	HSL-45	
SH-60B	162346	1		IV	1	P					*
SH-60B	162346	2		IV	1	P					*
SH-60B	162346	3		IV	1	P					*
SH-60B	162346	4		IV	1	P					*
SH-60B	162346	5	8/94	IV	1	P	5576.1	8-Aug-94	NORIS	HSL-45	
SH-60B	162347	1	5/97	IV	2	P	6123.2	29-May-96	CHPT	HSL-44	
SH-60B	162347	2	5/98	IV	2	P	6220.0	7-Apr-97	CHPT	HSL-44	
SH-60B	162348	1	3/98	IV	2	P		6-Feb-97	NAPRA	HSL-51	
SH-60B	162349	1		IV	1	P					*
SH-60B	162349	2		IV	1	P					*
SH-60B	162349	3		IV	1	P					*
SH-60B	162349	4	9/94	IV	1	P	1110.2	2-Nov-94	CHPT	VX-1	
SH-60B	162349	5	9/95	IV	1	P		8-Nov-95	CHPT	VX-1	

TMS	BUNO	ASPA	PED	LOT	TOUR	P/F	FLT HRS	REPORT	DEPOT	UNIT	
SH-60B	162975	1		V	1	P					*
SH-60B	162975	2		V	1	P					*
SH-60B	162975	3		V	1	P					*
SH-60B	162975	4	3/96	V	1	P	3463.9	27-Jan-95	NAPRA	HSL-51	
SH-60B	162975	5	3/97	V	1	P	3998.7	22-Mar-96	NAPRA	HSL-51	
SH-60B	162975	6	3/97	V	1	F	4462.9	25-Mar-97	NORIS	HSL-43	
SH-60B	162976	1		V	1	P					*
SH-60B	162976	2		V	1	P					*
SH-60B	162976	3		V	1	P					*
SH-60B	162976	4		V	1	P					*
SH-60B	162976	5	1/95	V	1	P	4817.6	10-Jan-95	NORIS	HSL-43	
SH-60B	162977	1		V	1	P					*
SH-60B	162977	2		V	1	P					*
SH-60B	162977	3		V	1	P					*
SH-60B	162977	4	10/95	V	1	P	4731.8	8-Dec-94	CHPT	HSL-44	
SH-60B	162980	1		V	1	P					*
SH-60B	162980	2		V	1	P					*
SH-60B	162980	3		V	1	P					*
SH-60B	162980	4	7/94	V	1	P	4660.8	24-Aug-94	NORIS	HSL-45	
SH-60B	162980	5	7/96	V	1	P	4837.3	19-Apr-95	NORIS	HSL-45	
SH-60B	162980	6	4/98	V	1	P	5754.3	19-Dec-96	NORIS	HSL-45	
SH-60B	162981	1		V	1	P					*
SH-60B	162981	2		V	1	P					*
SH-60B	162981	3	8/93	V	1	P	3863.3	16-Apr-93	PNCLA	HSL-44	
SH-60B	162981	4	8/94	V	1	F	4728.1	24-Jun-94	PNCLA	HSL-44	
SH-60B	162982	1		V	1	P					*
SH-60B	162982	2		V	1	P					*
SH-60B	162982	3		V	1	P					*
SH-60B	162982	4	3/96	V	1	P		27-Apr-95	CHPT	HSL-46	
SH-60B	162982	5	3/97	V	1	P	4696.7	20-Mar-96	CHPT	HSL-46	
SH-60B	162982	6	3/98	V	1	P		10-Jan-97	CHPT	HSL-46	
SH-60B	162984	1		V	1	P					*
SH-60B	162984	2		V	1	P					*
SH-60B	162984	3		V	1	P					*
SH-60B	162984	4		V	1	P					*
SH-60B	162984	5	11/96	V	1	P		4-Aug-95	CHPT	HSL-42	
SH-60B	162984	6	11/97	V	1	P		7-Aug-96	CHPT	HSL-42	
SH-60B	162985	1		V	1	P					*
SH-60B	162985	2		V	1	P					*
SH-60B	162985	3		V	1	P					*
SH-60B	162985	4	6/96	V	1	P		17-Mar-95	NORIS	HSL-47	
SH-60B	162985	5	5/97	V	1	P	4489.9	17-Jun-96	NORIS	HSL-47	
SH-60B	162985	6	5/97	V	1	F		26-Jun-97	NORIS	HSL-47	
SH-60B	162986	1		V	1	P					*
SH-60B	162986	2		V	1	P					*
SH-60B	162986	3		V	1	P					*
SH-60B	162986	4	12/95	V	1	P		12-Oct-94	JAX	HSL-48	
SH-60B	162986	5	12/96	V	1	P		25-Jul-95	CHPT	HSL-48	
SH-60B	162986	6	12/97	V	1	P		22-Oct-96	CHPT	HSL-48	
SH-60B	162987	1		V	1	P					*
SH-60B	162987	2		V	1	P					*
SH-60B	162987	3		V	1	P					*
SH-60B	162987	4	6/94	V	1	P	4118.6	11-Jan-94	NORIS	HSL-37	
SH-60B	162987	5		V	1	P					*
SH-60B	162987	6	12/97	V	1	P	5828.2	11-Dec-96	NORIS	HSL-47	
SH-60B	162988	1		V	1	P					*
SH-60B	162988	2		V	1	P					*

TMS	BUNO	ASPA	PED	LOT	TOUR	P/F	FLT HRS	REPORT	DEPOT	UNIT	
SH-60B	162988	3		V	1	P					*
SH-60B	162988	4	11/95	V	1	P		21-Jul-94	NORIS	HSL-37	
SH-60B	162988	5	11/96	V	1	P	4946.0	17-Aug-95	NORIS	HSL-37	
SH-60B	162988	6	6/98	V	1	P	5454.7	10-Mar-97	NORIS	HSL-43	
SH-60B	162989	1		V	1	P					*
SH-60B	162989	2		V	1	P					*
SH-60B	162989	3		V	1	P					*
SH-60B	162989	4	1/96	V	1	P		4-Aug-94	PNCLA	HSL-46	
SH-60B	162989	5	1/97	V	1	P		2-Aug-95	CHPT	HSL-46	
SH-60B	162989	6	1/97	V	1	F		13-Nov-96	CHPT	HSL-46	
SH-60B	162991	1		V	1	P					*
SH-60B	162991	2		V	1	P					*
SH-60B	162991	3		V	1	P					*
SH-60B	162991	4	1/96	V	1	P	6074.6	20-Mar-95	NAPRA	HSL-51	
SH-60B	162991	5	1/97	V	1	P	6408.6	2-Feb-96	NAPRA	HSL-51	
SH-60B	162991	6	8/98	V	1	P		30-Jun-97	NORIS	HSL-45	
SH-60B	163233	1		VI	1	P					*
SH-60B	163233	2		VI	1	P					*
SH-60B	163233	3		VI	1	P					*
SH-60B	163233	4	3/95	VI	1	P		26-Apr-95	CHPT	HSL-46	
SH-60B	163233	5	3/97	VI	1	P		11-Oct-95	CHPT	HSL-46	
SH-60B	163233	6	1/97	VI	1	F		24-Jan-97	CHPT	HSL-46	
SH-60B	163234	1		VI	1	P					*
SH-60B	163234	2		VI	1	P					*
SH-60B	163234	3		VI	1	P					*
SH-60B	163234	4	1/96	VI	1	P	3196.0	6-Dec-94	CHPT	HSL-48	
SH-60B	163234	5	1/97	VI	1	P		3-Jan-96	CHPT	HSL-48	
SH-60B	163234	6	1/98	VI	1	P	4065.8	26-Sep-96	CHPT	HSL-48	
SH-60B	163235	1		VI	1	P					*
SH-60B	163235	2		VI	1	P					*
SH-60B	163235	3		VI	1	P					*
SH-60B	163235	4	5/96	VI	1	P		14-Sep-94	PNCLA	HSL-46	
SH-60B	163235	5	5/96	VI	1	F		31-Jul-96	CHPT	HSL-46	
SH-60B	163237	1		VI	1	P					*
SH-60B	163237	2		VI	1	P					*
SH-60B	163237	3	7/95	VI	1	P		28-Jun-94	PNCLA	HSL-46	
SH-60B	163237	4	7/96	VI	1	P	4353.0	2-Feb-95	CHPT	HSL-46	
SH-60B	163237	5	7/97	VI	1	P		29-Feb-96	CHPT	HSL-46	
SH-60B	163237	6	7/98	VI	1	P	5937.8	14-Mar-97	CHPT	HSL-46	
SH-60B	163238	1		VI	1	P					*
SH-60B	163238	2		VI	1	P					*
SH-60B	163238	3		VI	1	P					*
SH-60B	163238	4		VI	1	P					*
SH-60B	163238	5	4/96	VI	1	F		1-Nov-95	CHPT	HSL-46	
SH-60B	163239	1		VI	1	P					*
SH-60B	163239	2		VI	1	P					*
SH-60B	163239	3		VI	1	P					*
SH-60B	163239	4	6/95	VI	1	F		8-Jun-95	CHPT	HSL-46	
SH-60B	163241	1		VI	1	P					*
SH-60B	163241	2		VI	1	P					*
SH-60B	163241	3		VI	1	P					*
SH-60B	163241	4	4/96	VI	1	P	5180.3	16-May-95	NORIS	HSL-43	
SH-60B	163241	5	4/97	VI	1	P	5327.0	12-Jan-96	NORIS	HSL-43	
SH-60B	163243	1	7/96	VI	2	F		2-Jul-96	CHPT	HSL-46	
SH-60B	163244	1		VI	1	P					*
SH-60B	163244	2		VI	1	P					*
SH-60B	163244	3	1/96	VI	1	P	3824.4	21-Nov-94	CHPT	HSL-46	

TMS	BUNO	ASPA	PED	LOT	TOUR	P/F	FLT HRS	REPORT	DEPOT	UNIT	
SH-60B	163244	4	1/97	VI	1	P		30-Jan-96	CHPT	HSL-46	
SH-60B	163244	5	1/97	VI	1	F	4886.3	7-Mar-97	NORIS	HSL-47	
SH-60B	163245	1		VI	1	P					*
SH-60B	163245	2		VI	1	P					*
SH-60B	163245	3	12/95	VI	1	P	3691.1	21-Dec-94	CHPT	HSL-48	
SH-60B	163245	4	12/96	VI	1	P		4-Oct-95	CHPT	HSL-48	
SH-60B	163245	5	12/97	VI	1	P		24-Jul-96	CHPT	HSL-48	
SH-60B	163245	6	12/97	VI	1	F		9-Jul-97	CHPT	HSL-48	
SH-60B	163246	1		VI	1	P					*
SH-60B	163246	2		VI	1	P					*
SH-60B	163246	3		VI	1	P					*
SH-60B	163246	4	4/96	VI	1	F	5255.3	14-Feb-96	NORIS	HSL-43	
SH-60B	163247	1		VI	1	P					*
SH-60B	163247	2		VI	1	P					*
SH-60B	163247	3	11/95	VI	1	P		22-Nov-94	NORIS	HSL-49	
SH-60B	163247	4	3/97	VI	1	P	4696.3	6-Dec-95	NORIS	HSL-49	
SH-60B	163247	5	3/98	VI	1	P	5815.1	28-Apr-97	NORIS	HSL-49	
SH-60B	163248	1		VI	1	P					*
SH-60B	163248	2		VI	1	P					*
SH-60B	163248	3	12/95	VI	1	P	4152.4	30-Nov-94	CHPT	HSL-48	
SH-60B	163248	4	12/96	VI	1	P		14-Sep-95	CHPT	HSL-48	
SH-60B	163248	5	12/97	VI	1	P		13-Dec-96	CHPT	HSL-48	
SH-60B	163248	6	12/98	VI	1	P		10-Jul-97	CHPT	HSL-48	
SH-60B	163249	1		VI	1	P					*
SH-60B	163249	2		VI	1	P					*
SH-60B	163249	3	1/96	VI	1	P		23-Aug-94	PNCLA	HSL-46	
SH-60B	163249	4	1/97	VI	1	P		5-Jan-96	CHPT	HSL-46	
SH-60B	163249	5	1/98	VI	1	P	6336.1	7-Feb-97	CHPT	HSL-46	
SH-60B	163249	6	1/99	VI	1	P		23-Jul-97	CHPT	HSL-46	
SH-60B	163593	1		VII	1	P					*
SH-60B	163593	2		VII	1	P					*
SH-60B	163593	3		VII	1	P					*
SH-60B	163593	4	2/96	VII	1	F	4380.6	16-Nov-95	CHPT	HSL-46	
SH-60B	163594	1		VII	1	P					*
SH-60B	163594	2		VII	1	P					*
SH-60B	163594	3	2/96	VII	1	P		30-Nov-94	NORIS	HSL-49	
SH-60B	163594	4	2/97	VII	1	P	4564.2	2-Jul-96	NORIS	HSL-49	
SH-60B	163594	5	2/98	VII	1	P	5057.9	29-Apr-97	NORIS	HSL-49	
SH-60B	163595	1		VII	1	P					*
SH-60B	163595	2	8/94	VII	1	P	3159.9	23-Nov-94	CHPT	HSL-48	
SH-60B	163595	3	8/95	VII	1	F	3800.8	24-Oct-95	CHPT	HSL-48	
SH-60B	163596	1		VII	1	P					*
SH-60B	163596	2	8/95	VII	1	P	3717.3	23-Aug-94	NORIS	HSL-37	
SH-60B	163596	3	1/97	VII	1	P	4527.1	12-Mar-96	NORIS	HSL-37	
SH-60B	163596	4	1/98	VII	1	P	4832.6	21-Aug-96	NORIS	HSL-37	
SH-60B	163597	1		VII	1	P					*
SH-60B	163597	2	7/95	VII	1	P		23-Jun-94	PNCLA	HSL-48	
SH-60B	163597	3	7/96	VII	1	P		10-Oct-95	CHPT	HSL-48	
SH-60B	163597	4	7/97	VII	1	P		6-Feb-96	JAX	HSL-48	
SH-60B	163597	5	7/97	VII	1	P	4786.6	26-Feb-97	CHPT	HSL-48	
SH-60B	163598	1		VII	1	P					*
SH-60B	163598	2	9/95	VII	1	P		21-Jul-94	NORIS	HSL-37	
SH-60B	163905	1		VII	1	P					*
SH-60B	163905	2	10/95	VII	1	P	3116.5	14-Dec-94	CHPT	HSL-48	
SH-60B	163905	3	10/96	VII	1	P		21-Nov-95	CHPT	HSL-48	
SH-60B	163905	4	10/97	VII	1	P		1-May-96	CHPT	HSL-48	
SH-60B	163906	1		VII	1	P					*

TMS	BUNO	ASPA	PED	LOT	TOUR	P/F	FLT HRS	REPORT	DEPOT	UNIT	
SH-60B	163906	2	7/96	VII	1	P	3333.0	29-Jun-95	NORIS	HSL-43	
SH-60B	163906	3	7/97	VII	1	P	3997.0	6-May-96	NORIS	HSL-43	
SH-60B	163906	4	7/97	VII	1	P	4725.5	19-Jun-97	NORIS	HSL-43	
SH-60B	163908	1		VII	1	P					*
SH-60B	163908	2	5/96	VII	1	P		31-Aug-95	CHPT	HSL-42	
SH-60B	163908	3	5/97	VII	1	P		23-Jul-96	JAX	HSL-42	
SH-60B	163908	4	5/98	VII	1	P	3811.3	18-Apr-97	CHPT	HSL-42	
SH-60B	163909	1		VII	1	P					*
SH-60B	163909	2		VII	1	P					*
SH-60B	163909	3	7/96	VII	1	F	4161.7	5-Mar-97	NORIS	HSL-43	
SH-60B	163910	1	9/95	VII	1	P		25-Aug-94	PNCLA	HSL-42	
SH-60B	163910	2	9/96	VII	1	P		5-Oct-95	CHPT	HSL-42	
SH-60B	163910	3	9/97	VII	1	P		9-Apr-96	JAX	HSL-42	
SH-60B	163910	4	9/98	VII	1	P	3968.3	29-Apr-97	CHPT	HSL-42	
SH-60B	164174	1	10/95	IX	1	P	933.5	19-Jan-95	CHPT	VX-1	
SH-60B	164174	2		IX	1	P					*
SH-60B	164174	3	10/97	IX	1	P		23-Oct-96	CHPT	HSL-44	
SH-60B	164175	1		IX	1	P					*
SH-60B	164175	2	2/97	IX	1	P		27-Dec-95	CHPT	HSL-44	
SH-60B	164175	3	2/98	IX	1	P		15-Nov-96	CHPT	HSL-44	
SH-60B	164176	1	4/96	IX	1	P	729.6	12-Apr-95	CHPT	RWTESTRON	
SH-60B	164176	2	4/97	IX	1	P		11-Mar-96	CHPT	RWTESTRON	
SH-60B	164176	3	4/98	IX	1	P		21-May-97	CHPT	RWTESTRON	
SH-60B	164177	1	8/96	IX	1	P	3163.8	17-Oct-95	NORIS	HSL-43	
SH-60B	164177	2	8/97	IX	1	P	3514.9	17-Apr-96	NORIS	HSL-43	
SH-60B	164177	3	8/98	IX	1	P		7-Aug-97	NORIS	HSL-43	
SH-60B	164178	1	12/96	IX	1	P	2799.6	9-Nov-95	NORIS	HSL-45	
SH-60B	164178	2	12/97	IX	1	P	3409.9	20-Dec-96	NORIS	HSL-45	
SH-60B	164179	1	10/96	IX	1	P	2338.0	6-Dec-95	CHPT	HSL-44	
SH-60B	164179	2	10/97	IX	1	P		8-Nov-96	CHPT	HSL-44	
SH-60B	164461	1	11/96	X	1	P	2427.9	6-Nov-95	NORIS	HSL-41	
SH-60B	164461	2	11/97	X	1	P	2856.7	11-Jun-96	NORIS	HSL-41	
SH-60B	164462	1	2/97	X	1	P		31-May-96	CHPT	VX-1	
SH-60B	164462	2	2/98	X	1	P		22-May-97	CHPT	VX-1	
SH-60B	164463	1	4/98	X	1	P	3710.4	24-Apr-97	NORIS	HSL-43	
SH-60B	164464	1	5/98	X	1	P	3525.0	25-Feb-97	NORIS	HSL-47	
SH-60B	164465	1	7/97	X	1	P	2606.5	5-Feb-97	CHPT	HSL-48	
SH-60B	164848	1	11/98	XI	1	P		16-Jun-97	CHPT	HSL-46	
SH-60F	163282	1		I	1	P					*
SH-60F	163282	2		I	1	P					*
SH-60F	163282	3		I	1	P					*
SH-60F	163282	4	9/95	I	1	P	1722.3	4-Nov-94	CHPT	VX-1	
SH-60F	163282	5	9/96	I	1	P		6-Nov-95	CHPT	VX-1	
SH-60F	163283	1		I	1	P					*
SH-60F	163283	2		I	1	P					*
SH-60F	163283	3		I	1	P					*
SH-60F	163283	4	12/96	I	1	P		21-Mar-96	CHPT	RWTESTRON	
SH-60F	163283	5	12/97	I	1	P		30-Jul-96	CHPT	RWTESTRON	
SH-60F	163284	1		II	1	P					*
SH-60F	163284	2		II	1	P					*
SH-60F	163284	3	5/96	II	1	P		9-May-95	CHPT	HS-1	
SH-60F	163284	4	5/97	II	1	P		10-Jun-96	CHPT	HS-1	
SH-60F	163284	5	5/98	II	1	P		10-Dec-96		HS-1	
SH-60F	163285	1		II	1	P					*
SH-60F	163285	2		II	1	P					*
SH-60F	163285	3	1/96	II	1	P		22-Nov-94	NORIS	HS-1	
SH-60F	163285	4	1/97	II	1	P		11-Oct-95	CHPT	HS-1	

TMS	BUNO	ASPA	PED	LOT	TOUR	P/F	FLT HRS	REPORT	DEPOT	UNIT	
SH-60F	163285	5	1/98	II	1	P	2500.5	20-Nov-96	NORIS	NSAWC	
SH-60F	163286	1		II	1	P					*
SH-60F	163286	2	8/95	II	1	P	2051.8	14-Jul-94	NORIS	HS-10	
SH-60F	163286	3	8/96	II	1	P	2365.8	16-Jun-95	NORIS	HS-10	
SH-60F	163286	4	8/97	II	1	P	3105.6	15-Aug-96	NORIS	HS-10	
SH-60F	163286	5	8/98	II	1	P	3444.4	21-May-97	NORIS	HS-10	
SH-60F	163287	1		II	1	P					*
SH-60F	163287	2		II	1	P					*
SH-60F	163287	3	1/96	II	1	P	2211.0	21-Oct-94	NORIS	HS-1	
SH-60F	163287	4	1/97	II	1	P	2262.9	17-Aug-95	CHPT	HS-1	
SH-60F	163287	5	1/98	II	1	P	2487.3	11-Feb-97	NORIS	NSAWC	
SH-60F	163288	1		II	1	P					*
SH-60F	163288	2		II	1	P					*
SH-60F	163288	3	4/96	II	1	P	2009.0	19-Jan-95	NORIS	HS-1	
SH-60F	163288	4	4/96	II	1	P	2273.9	12-Dec-95	CHPT	HS-1	
SH-60F	163288	5	4/98	II	1	P	2950.1	9-Dec-96	NORIS	HS-1	
SH-60F	164069	1		III	1	P					*
SH-60F	164069	2		III	1	P					*
SH-60F	164069	3	1/96	III	1	P	1562.9	20-Jan-95	CHPT	RWTESTRON	
SH-60F	164069	4	8/97	III	1	P		22-Jul-96	CHPT	RWTESTRON	
SH-60F	164069	5	8/98	III	1	P	1736.3	6-May-97	CHPT	RWTESTRON	
SH-60F	164070	1		III	1	P					*
SH-60F	164070	2		III	1	P					*
SH-60F	164070	3	12/95	III	1	P	1354.9	18-Jan-95	CHPT	VX-1	
SH-60F	164070	4	12/96	III	1	P		29-Mar-96	CHPT	VX-1	
SH-60F	164070	5	12/97	III	1	P	1856.3	27-Feb-97	CHPT	VX-1	
SH-60F	164071	1		III	1	P					*
SH-60F	164071	2		III	1	P					*
SH-60F	164071	3	3/95	III	1	P	2337.4	1-Mar-95	CHPT	HS-1	
SH-60F	164071	4	3/97	III	1	P		14-Mar-96	CHPT	HS-1	
SH-60F	164071	5	3/97	III	1	P		2-Oct-96	CHPT	HS-1	
SH-60F	164073	1		III	1	P					*
SH-60F	164073	2		III	1	P					*
SH-60F	164073	3	4/96	III	1	P	1766.7	20-Jan-95	NORIS	HS-10	
SH-60F	164073	4	4/97	III	1	P	1776.1	18-Mar-96	NORIS	HS-10	
SH-60F	164073	5	4/98	III	1	P	2205.9	7-Feb-97	NORIS	HS-10	
SH-60F	164074	1		III	1	P					*
SH-60F	164074	2		III	1	P					*
SH-60F	164074	3	6/96	III	1	P	2649.3	14-Jul-95	NORIS	HS-10	
SH-60F	164074	4	6/97	III	1	P		12-Apr-96	NORIS	HS-10	
SH-60F	164074	5	6/98	III	1	P	3601.2	2-Apr-97	NORIS	HS-10	
SH-60F	164075	1		III	1	P					*
SH-60F	164075	2		III	1	P					*
SH-60F	164075	3		III	1	P					*
SH-60F	164075	4		III	1	P					*
SH-60F	164075	5	4/98	III	1	P	3552.4	30-Apr-97	NORIS	HS-4	
SH-60F	164076	1		III	1	P					*
SH-60F	164076	2		III	1	P					*
SH-60F	164076	3	4/96	III	1	P		13-Mar-95	NORIS	HS-10	
SH-60F	164076	4	4/97	III	1	P	2532	29-Feb-96	NORIS	HS-10	
SH-60F	164076	5	4/98	III	1	P	2948.1	16-Jan-97	NORIS	HS-10	
SH-60F	164077	1		III	1	P					*
SH-60F	164077	2		III	1	P					*
SH-60F	164077	3	4/96	III	1	P		2-May-95	NORIS	HS-10	
SH-60F	164077	4	4/97	III	1	P		18-Apr-96	NORIS	HS-10	
SH-60F	164077	5	4/98	III	1	P	3079.6	19-Feb-97	NORIS	HS-10	
SH-60F	164078	1		III	1	P					*

TMS	BUNO	ASPA	PED	LOT	TOUR	P/F	FLT HRS	REPORT	DEPOT	UNIT	
SH-60F	164078	2	6/94	III	1	P	2287.5	7-Jul-94	NORIS	HS-2	
SH-60F	164078	3	6/96	III	1	P	2482.6	15-May-95	NORIS	HS-10	
SH-60F	164078	4	6/97	III	1	P	2764.7	1-May-96	NORIS	HS-10	
SH-60F	164078	5	6/98	III	1	P	3338.2	12-Mar-97	NORIS	HS-10	
SH-60F	164079	1		III	1	P					*
SH-60F	164079	2	8/94	III	1	P	2167.5	4-Aug-94	NORIS	HS-2	
SH-60F	164079	3	8/95	III	1	F		28-Aug-95	NORIS	HS-2	
SH-60F	164080	1		III	1	P					*
SH-60F	164080	2	11/94	III	1	P	1726.3	19-Aug-94	NORIS	HS-10	
SH-60F	164080	3	11/96	III	1	P	2216.8	21-Nov-95	NORIS	HS-10	
SH-60F	164080	4	11/97	III	1	P	2743.8	2-Oct-96	NORIS	HS-10	
SH-60F	164081	1		III	1	P					*
SH-60F	164081	2		III	1	P					*
SH-60F	164081	3		III	1	P					*
SH-60F	164081	4	7/97	III	1	P	2429.5	14-May-96	NORIS	HS-10	
SH-60F	164081	5	7/98	III	1	P	2634.8	10-Jun-97	NORIS	HS-10	
SH-60F	164082	1		III	1	P					*
SH-60F	164082	2	9/94	III	1	P	1885.1	28-Jul-94	NORIS	HS-2	
SH-60F	164082	3	9/96	III	1	P		8-Nov-95	NORIS	HS-10	
SH-60F	164082	4	9/96	III	1	F	2848.6	19-Sep-96	NORIS	HS-10	
SH-60F	164083	1		III	1	P					*
SH-60F	164083	2		III	1	P					*
SH-60F	164083	3	10/96	III	1	P	2694.4	13-Nov-95	NORIS	HS-6	
SH-60F	164083	4	10/97	III	1	P	3130.5	17-Jul-96	NORIS	HS-6	
SH-60F	164083	5	10/98	III	1	P	3644.8	16-Jun-97	NORIS	HS-6	
SH-60F	164084	1		III	1	P					*
SH-60F	164084	2		III	1	P					*
SH-60F	164084	3	10/96	III	1	P		17-Nov-95	NORIS	HS-6	
SH-60F	164084	4	10/97	III	1	P	2887.6	4-Jun-96	NORIS	HS-2	
SH-60F	164085	1		III	1	P					*
SH-60F	164085	2	10/94	III	1	P	1949.5	20-Jun-94	NORIS	HS-6	
SH-60F	164085	3	10/96	III	1	P	2929.2	4-Dec-95	NORIS	HS-6	
SH-60F	164085	4	10/97	III	1	P	3377.8	19-Jul-96	NORIS	HS-6	
SH-60F	164085	5	10/97	III	1	F	3836.9	18-Jun-97	NORIS	HS-6	
SH-60F	164086	1	6/94	III	1	P	1570.1	18-Aug-94	NORIS	HS-10	
SH-60F	164086	2	6/95	III	1	P	1757.4	16-Aug-95	NORIS	HS-10	
SH-60F	164086	3	6/97	III	1	P	1905.8	28-Mar-96	NORIS	HS-10	
SH-60F	164086	4	6/97	III	1	P	1905.8	23-Apr-97	NORIS	HS-10	
SH-60F	164087	1		IV	1	P					*
SH-60F	164087	2	12/94	IV	1	P	1020.9	15-Sep-94	NORIS	HS-10	
SH-60F	164087	3	12/96	IV	1	P	1618.5	7-Dec-95	NORIS	HS-10	
SH-60F	164087	4	12/97	IV	1	P	2042.3	23-Oct-96	NORIS	HS-10	
SH-60F	164088	1		IV	1	P					*
SH-60F	164088	2	12/95	IV	1	P	1842.4	6-Oct-94	NORIS	HS-2	
SH-60F	164088	3	12/96	IV	1	P	2465.2	7-Nov-95	NORIS	HS-2	
SH-60F	164088	4	12/97	IV	1	P	2677.8	20-Aug-96	NORIS	HS-2	
SH-60F	164088	5	12/98	IV	1	P	3051.2	9-Jun-97	NORIS	HS-8	
SH-60F	164089	1		IV	1	P					*
SH-60F	164089	2	12/95	IV	1	P		12-Jan-95	NORIS	HS-4	
SH-60F	164089	3	12/95	IV	1	P	2541.9	24-Oct-95	NORIS	HS-4	
SH-60F	164089	4	12/96	IV	1	F	2675.1	21-Nov-96	NORIS	NSAWC	
SH-60F	164091	1		IV	1	P					
SH-60F	164091	2	1/96	IV	1	P		13-Jan-95	NORIS	HS-4	
SH-60F	164091	3	1/97	IV	1	P		18-Jan-96	NORIS	HS-4	
SH-60F	164091	4	1/97	IV	1	F	3755.4	21-Jan-97	NORIS	HS-4	
SH-60F	164092	1		IV	1	P					*
SH-60F	164092	2	4/96	IV	1	P	2331.1	13-Jan-95		HS-4	

TMS	BUNO	ASPA	PED	LOT	TOUR	P/F	FLT HRS	REPORT	DEPOT	UNIT	
SH-60F	164092	3	4/97	IV	1	P	2754.0	28-Feb-96	NORIS	HS-4	
SH-60F	164092	4	4/98	IV	1	P	3107.6	9-May-97	NORIS	NSAWC	
SH-60F	164094	1		IV	1	P					*
SH-60F	164094	2	2/96	IV	1	P	2148.1	14-Jan-95	NORIS	HS-4	
SH-60F	164094	3	2/96	IV	1	F	2700.0	6-Feb-96	NORIS	HS-2	
SH-60F	164095	1		IV	1	P					*
SH-60F	164095	2	4/96	IV	1	P		11-Jan-95	NORIS	HS-4	
SH-60F	164095	3	4/97	IV	1	P	2154.9	23-Jan-96	NORIS	HS-4	
SH-60F	164095	4	4/98	IV	1	P	2587.5	9-Jan-97	NORIS	HS-4	
SH-60F	164097	1		IV	1	P					*
SH-60F	164097	2		IV	1	P					*
SH-60F	164097	3	5/97	IV	1	P		12-Jun-96	CHPT	HS-1	
SH-60F	164097	4	5/98	IV	1	P		10-Dec-96	CHPT	HS-1	
SH-60F	164098	1	8/94	IV	1	P	1380.7	15-Jul-94	NORIS	HS-10	
SH-60F	164098	2	8/95	IV	1	P	1756.6	18-Aug-95	NORIS	HS-10	
SH-60F	164098	3	8/97	IV	1	P		20-Jun-96	NORIS	HS-10	
SH-60F	164098	4	8/98	IV	1	P	2614.1	7-May-97	NORIS	HS-10	
SH-60F	164099	1		IV	1	P					*
SH-60F	164099	2	8/96	IV	1	P	1774.5	21-Aug-95	CHPT	HS-1	
SH-60F	164099	3	8/97	IV	1	P		7-Aug-96	CHPT	HS-3	
SH-60F	164099	4	8/98	IV	1	P	2619.3	25-Feb-97	CHPT	HS-3	
SH-60F	164100	1	8/95	IV	1	P	1022.0	12-Oct-94	CHPT	HS-1	
SH-60F	164100	2		IV	1	P					*
SH-60F	164100	3		IV	1	P					*
SH-60F	164100	4	7/98	IV	1	P		4-Feb-97	CHPT	HS-11	
SH-60F	164101	1	9/95	IV	1	P	1268.3	16-Nov-94	PNCLA	HS-1	
SH-60F	164101	2	9/96	IV	1	P	1893.6	15-Aug-95	CHPT	HS-1	
SH-60F	164101	3	9/97	IV	1	P		21-Aug-96	CHPT	HS-1	
SH-60F	164102	1	8/95	IV	1	P	1141.3	5-Oct-94	CHPT	HS-1	
SH-60F	164102	2	8/96	IV	1	P		14-Jul-95	CHPT	HS-1	
SH-60F	164102	3	8/97	IV	1	P		15-Aug-96	CHPT	HS-1	
SH-60F	164102	4	8/98	IV	1	P	2169.7	18-Mar-97	CHPT	HS-1	
SH-60F	164103	1		IV	1	P					*
SH-60F	164103	2	9/96	IV	1	P		7-Jul-95	CHPT	HS-1	
SH-60F	164103	3	9/97	IV	1	P		21-Aug-96	CHPT	HS-1	
SH-60F	164104	1	10/95	IV	1	P		8-Nov-94	CHPT	HS-1	
SH-60F	164104	2	10/96	IV	1	P		18-Jul-95	CHPT	HS-1	
SH-60F	164104	3	10/97	IV	1	P		20-Jun-96	CHPT	HS-7	
SH-60F	164443	1	12/95	V	1	P		30-Mar-95	CHPT	VX-1	
SH-60F	164443	2	12/96	V	1	P		7-Mar-96	CHPT	VX-1	
SH-60F	164443	3	12/97	V	1	P		4-Apr-97	CHPT	VX-1	
SH-60F	164444	1	11/95	V	1	P	1368.8	22-Nov-94	NORIS	HS-8	
SH-60F	164444	2	11/96	V	1	P	2941.1	31-Oct-95	NORIS	HS-8	
SH-60F	164444	3	11/97	V	1	F	2480.9	22-Jul-96	NORIS	HS-8	
SH-60F	164445	1	1/96	V	1	P		23-Jan-95	NORIS	HS-8	
SH-60F	164445	2	1/97	V	1	P	1998.3	30-Oct-95	NORIS	HS-8	
SH-60F	164445	3	1/97	V	1	P	2478.5	2-Dec-96	NORIS	HS-8	
SH-60F	164445	4	1/98	V	1	P	2713.9	29-May-97	NORIS	HS-8	
SH-60F	164446	1	12/95	V	1	P	1472.8	22-Nov-94	NORIS	HS-8	
SH-60F	164446	2	12/96	V	1	P	2091.0	1-Nov-95	NORIS	HS-8	
SH-60F	164446	3	12/97	V	1	P	2657.9	4-Dec-96	NORIS	HS-10	
SH-60F	164447	1	1/95	V	1	P	1509.4	10-Feb-95	NORIS	HS-8	
SH-60F	164447	2	1/97	V	1	P	2029.3	9-Jan-96	NORIS	HS-2	
SH-60F	164447	3	1/97	V	1	P	2405.5	30-Sep-96	NORIS	HS-2	
SH-60F	164448	1	3/96	V	1	P	1471.7	11-Apr-95	NORIS	HS-8	
SH-60F	164448	2	3/97	V	1	P		3-Nov-95	NORIS	HS-8	
SH-60F	164448	3	3/98	V	1	P	2383.3	19-Dec-96	NORIS	HS-8	

TMS	BUNO	ASPA	PED	LOT	TOUR	P/F	FLT HRS	REPORT	DEPOT	UNIT	
SH-60F	164449	1		V	1	P					*
SH-60F	164449	2	3/97	V	1	P	2270.4	26-Mar-96	NORIS	HS-4	
SH-60F	164449	3	3/98	V	1	P	2767.9	11-Apr-97	NORIS	HS-4	
SH-60F	164450	1	3/96	V	1	P	972.7	4-Oct-94	CHPT	HS-3	
SH-60F	164450	2	3/97	V	1	P		22-Oct-95	CHPT	HS-3	
SH-60F	164450	3	3/98	V	1	P		8-Jan-97	CHPT	HS-3	
SH-60F	164451	1	4/96	V	1	P	1141.2	10-Jan-95	CHPT	HS-3	
SH-60F	164451	2	4/97	V	1	P		11-Feb-96	CHPT	HS-3	
SH-60F	164451	3	4/98	V	1	P		9-Jan-97	CHPT	HS-3	
SH-60F	164452	1	4/96	V	1	P	1512.4	9-Mar-95	CHPT	HS-1	
SH-60F	164452	2	4/97	V	1	P		11-Jan-95	CHPT	HS-5	
SH-60F	164452	3	4/98	V	1	P	2476.9	17-Apr-97	CHPT	HS-5	
SH-60F	164453	1	4/95	V	1	P	1293.7	28-Feb-95	CHPT	HS-1	
SH-60F	164453	2	4/97	V	1	P		10-Jan-95	CHPT	HS-5	
SH-60F	164453	3	4/98	V	1	P	2411.1	19-Mar-97	CHPT	HS-5	
SH-60F	164454	1	7/96	V	1	P	1185.3	13-Feb-95	CHPT	HS-3	
SH-60F	164454	2	7/97	V	1	P		10-Feb-96	CHPT	HS-3	
SH-60F	164454	3	7/98	V	1	P	2130.9	13-Feb-97	CHPT	HS-3	
SH-60F	164455	1	6/96	V	1	P	1344.4	11-Jan-95	CHPT	HS-3	
SH-60F	164455	2	6/97	V	1	P		22-Feb-96	CHPT	HS-3	
SH-60F	164455	3	6/98	V	1	P		23-Jan-97	CHPT	HS-3	
SH-60F	164456	1	8/95	V	1	P	1865.8	17-Jul-95	NORIS	HS-2	
SH-60F	164456	2	8/97	V	1	P	2311.5	9-May-96	NORIS	HS-2	
SH-60F	164456	3	8/98	V	1	P	2684.3	3-Mar-97	NORIS	HS-4	
SH-60F	164457	1		V	1	P					*
SH-60F	164457	2	8/97	V	1	P	2225.8	30-Apr-96	NORIS	HS-6	
SH-60F	164457	3	8/98	V	1	P	2912.5	22-May-97	NORIS	HS-6	
SH-60F	164458	1	9/96	V	1	P	1903.4	11-Oct-95	NORIS	HS-2	
SH-60F	164458	2	9/97	V	1	P		29-May-96	NORIS	HS-2	
SH-60F	164458	3	8/98	V	1	P	2351.0	4-Mar-97	NORIS	HS-2	
SH-60F	164459	1	10/96	V	1	P	1073.1	11-Jul-95	NAPRA	HS-14	
SH-60F	164459	2	10/97	V	1	P	1657.2	26-Jul-96	NAPRA	HS-14	
SH-60F	164459	3	10/98	V	1	P		26-Jun-97	NAPRA	HS-14	
SH-60F	164460	1	10/96	V	1	P	1429.2	14-Jul-95	NAPRA	HS-14	
SH-60F	164460	2	10/97	V	1	P	2025.6	19-Jul-96	NAPRA	HS-14	
SH-60F	164609	1		VI	1	P					*
SH-60F	164609	2	10/97	VI	1	P		26-Jun-96	CHPT	HS-7	
SH-60F	164610	1	11/96	VI	1	P		27-Jun-95	CHPT	HS-15	
SH-60F	164612	1	1/97	VI	1	P		12-Jul-95	CHPT	HS-7	
SH-60F	164612	2	12/97	VI	1	P		9-Jul-96	CHPT	HS-7	
SH-60F	164613	1	2/96	VI	1	P	1501.4	25-Jan-95	CHPT	HS-15	
SH-60F	164613	2	2/97	VI	1	P					
SH-60F	164613	3	2/98	VI	1	P	2157.7	12-Mar-97	CHPT	HS-15	
SH-60F	164614	1	3/97	VI	1	P	1827.3	19-Jan-96	CHPT	HS-15	
SH-60F	164614	2	3/98	VI	1	P	2535.0	4-Feb-97	CHPT	HS-15	
SH-60F	164615	1	4/97	VI	1	P	1506.3	23-Jan-96	CHPT	HS-15	
SH-60F	164615	2	4/98	VI	1	P	1690.8	10-Feb-97	CHPT	HS-15	
SH-60F	164617	1	6/97	VI	1	P	1091.2	4-Jan-96	NAPRA	HS-14	
SH-60F	164617	2	6/98	VI	1	P	1646.8	13-Jan-97	NAPRA	HS-14	
SH-60F	164618	1	7/97	VI	1	P	1339.4	17-Apr-96	CHPT	HS-15	
SH-60F	164618	2	7/98	VI	1	P	1750.8	11-Feb-97	CHPT	HS-15	
SH-60F	164619	1	8/97	VI	1	P	1231.4	2-May-96	NORIS	HS-6	
SH-60F	164619	2	8/98	VI	1	P	2023.3	19-May-97	NORIS	HS-6	
SH-60F	164620	1	10/97	VI	1	P	1331.5	25-Jun-96	NORIS	HS-8	
SH-60F	164620	2	10/98	VI	1	P	1995.2	12-Jun-97	NORIS	HS-8	
SH-60F	164796	1	10/97	VII	1	P	1337.8	12-Sep-96	CHPT	HS-5	
SH-60F	164796	2	10/98	VII	1	P		16-Jul-97	CHPT	HS-5	

TMS	BUNO	ASPA	PED	LOT	TOUR	P/F	FLT HRS	REPORT	DEPOT	UNIT	
SH-60F	164797	1	11/97	VII	1	P		9-Aug-96	NAPRA	HS-14	
SH-60F	164797	2	11/98	VII	1	P	1642.9	2-Jul-97	NAPRA	HS-14	
SH-60F	164798	1	1/98	VII	1	P	1404.0	16-Dec-96	NAPRA	HS-14	
SH-60F	164799	1	3/98	VII	1	P	1738.1	16-Apr-97	CHPT	HS-5	
SH-60F	164800	1	4/98	VII	1	P	1851.0	11-Apr-97	CHPT	HS-11	
SH-60F	164801	1	6/98	VII	1	P	1224.5	15-Apr-97	CHPT	HS-11	
SH-60F	164802	1	7/97	VII	1	F		15-Jul-97	CHPT	HS-11	
SH-60F	164803	1	10/98	VII	1	P		16-Jul-97		HS-11	
	* indicates where data (ASPA #, tour, P/F) was assumed										

APPENDIX G

NAVAL AVIATION MAINTENANCE STRUCTURE[1]

All Naval Aviation Maintenance is broken down into three levels: organizational, intermediate, and depot. This three tier maintenance concept allows for an extensive intermediate component repair concept to accompany the Naval Air Wings while deployed aboard a carrier. The depot level is heavy equipment oriented and has the specialized talents and equipment to allow for a complete overhaul of fleet aircraft but still maintain control and expertise organic to the Navy (DON, July 1991)

1. The Organizational Level

Organizational level maintenance is normally performed by an operating unit on a day to day basis in support of its own operation. The goal of all organizational level maintenance is to maintain the aircraft in a full mission capable status while continually improving the local maintenance process.

Organizational level functions can be defined under the following categories:

1. Report preparation
2. Inspections
3. Record Keeping
4. Incorporate TD's
5. Preventive maintenance
6. Handling
7. Servicing
8. Corrective maintenance

2. The Intermediate Level

The intermediate level of maintenance is performed by designated maintenance activities in direct support of the organizational levels. The mission of the Intermediate level is to enhance and sustain combat readiness and mission capability of the organizational level by providing quality and timely material support and component repair.

The total maintenance sphere of the intermediate level consists of on and off equipment material support to include:

1. Component repair
2. Manufacture of selected components
3. Perform aircraft maintenance when required
4. Age exploration under RCM
5. Incorporation of TD's
6. Component processing
7. Calibration for O & I-levels
8. Technical assists to O-levels

[1] Ramsey, Robert and Legidakes, Leo, *An Analysis of the Impact of ASPA on Organizational and Depot Level Maintenance*, Master's Thesis, Naval Postgraduate School, Monterey, CA, December, 1994.

3. The Depot Level

The depot level maintenance is performed at Naval Aviation Industrial establishments to assure the continual flying integrity of airframes and flight systems. Depot level maintenance is an extensive level of maintenance usually involving major overhaul or rebuilding of parts or components. The capabilities of depot level include the manufacture, modification, testing, inspecting, sampling and reclamation of aircraft parts.

The purpose of depot level maintenance is to support the lower levels of maintenance by providing engineering assistance and performing maintenance that is beyond the capabilities of organizational or intermediate levels.

The function of depot level maintenance may be defined as:

1. Complete overhaul of aircraft
2. Manufacture or modifications of engines, aircraft, and support equipment
3. Technical and engineering assist
4. Age exploration under RCM
5. Incorporate TD's
6. Manufacture or modify parts kits
7. Repair and rework components and support equipment
8 Repair and rework engines
9. Calibration

APPENDIX H

SAMPLE COST-CAPTURING SHEET

This appendix is a sample of those data elements that should be captured during Integrated Depot Maintenance. The general aircraft information and work standard data should be accurate and representative of the work to be performed. This data can be used to estimate future labor and material costs associated with specific depot maintenance tasks. Additional data elements can be added, as needed.

GENERAL AIRCRAFT INFORMATION:

BUNO: __________
INDUCTION DATE: __________
AGE (MONTHS): __________
TIME IN TOUR (MONTHS): __________
TOTAL AIRCRAFT HOURS: __________
HRS IN TOUR: __________
SHIPBOARD HRS: __________

The following sheets contain depot maintenance tasks divided among six aircraft sections and one area for general tasks. These are:

AREAS/ZONES

1-NOSE AND COCKPIT SECTION
2-CABIN AREA
3-TRANSITION SECTION
4-TAILCONE SECTION
5-TAIL PYLON SECTION
6-MAIN ROTOR PYLON SECTION
7-ALL/OTHER

Hours accumulated are man-hours associated with each task (i.e. - if aircraft tow takes 0.2 hours and 5 personnel, man-hours equal 1.0). The following skill levels apply to depot maintenance:

SKILLS

A-Aircraft Mechanic (ACM)
B-Sheetmetal Mechanic (SMM)
C-Aircraft Cleaner
D-Production Management/Control
F-Aircraft Electrician
G-Electronic Systems Mechanic
K-Painter
L-Fiberglass Mechanic
M-Machinist
N-Non-Destructive Inspection
O-Ordnance
P-Aircraft Preservation
Q-Quality Assurance
S-Aircraft Evaluator (PSA and E&E)
T-Aircraft Tow
V-Vibration Analysis Technician
W-Weight and Balance Technician

SAMPLE COST CAPTURING SHEET

AREA	SKILL	TASKS	WORK STD LEVEL (O,D,C)	WORK STD HOURS	TOTAL ACTUAL HOURS	O LEVEL HRS	CHERRY POINT HRS	CCAD HRS	SIKORSKY HRS	LOCKHEED MARTIN HRS
7	D	PRODUCTION CONTROL								
7	Q	QUALITY ASSURANCE								
		Pre-Induction								
7	G	PRE INDUCTION MISSION SYS BASELINE								
7	A	REMOVE, TAG & STORE LOOSE GEAR								
7	O	DE-ARM & REMOVE CADS								
7	E	JOINT SYSTEMS CHECKOUT								
7	S	JOINT INVENTORY OF AIRCRAFT								
7	T	TOW ACFT TO PRESERVATION AREA								
7	P	PURGE FUEL & PRESERVE ACFT								
7	A	TOW ACFT TO WASH AREA								
7	C	WASH AIRCRAFT								
7	P	PRESERVE CONNECTORS, POST WASH								
7	T	TOW ACFT TO REPAIR HANGAR								
7	A	INVENTORY AND PREP								
7	G	EM RMV BOTTLES, WAVEGUIDE PRESS								
7	G	O LEVEL TO INVENTORY INSPECTION								
7	G	PRESERVE AND STORE EQUIPMENT								
1	Q	QUALITY ASSURANCE								
1	F	AE DISASSEMBLY								
1	G	EM DISASSEMBLY								
1	A	ACM DISASSEMBLY								
1	B	SMM DISASSEMBLY AND ASSIST								
1	N	NON-DESTRUCTIVE TEST AND INSPECT								
1	S	E&E INSPECT								
1	M	MACHINIST INSPECTION AND REWORK								
1	L	FIBERGLASS REWORK								
1	C	CLEANING REWORK								
1	F	AE REWORK-I								
1	A	ACM REWORK-I								
1	G	EM REWORK-I								
1	B	SMM REWORK-I								
1	F	AE REWORK-II								
1	A	ACM REWORK-II								
1	G	EM REWORK-II								
1	B	SMM REWORK-II								
1	K	PAINT AND TOUCH-UP								
1	F	AE REASSEMBLY								
1	A	ACM REASSEMBLY								
1	G	EM REASSEMBLY								
1	B	SMM REASSEMBLY								
2	Q	QUALITY ASSURANCE								
2	F	AE DISASSEMBLY								
2	G	EM DISASSEMBLY								
2	A	ACM DISASSEMBLY								
2	B	SMM DISASSEMBLY AND ASSIST								
2	N	NON-DESTRUCTIVE TEST AND INSPECT								
2	S	E&E INSPECT								

SAMPLE COST CAPTURING SHEET

AREA	SKILL	TASKS	WORK STD LEVEL (O,D,C)	WORK STD HOURS	TOTAL ACTUAL HOURS	O LEVEL HRS	CHERRY POINT HRS	CCAD HRS	SIKORSKY HRS	LOCKHEED MARTIN HRS
7	D	PRODUCTION CONTROL								
7	Q	QUALITY ASSURANCE								
		Pre-Induction								
7	G	PRE INDUCTION MISSION SYS BASELINE								
7	A	REMOVE, TAG & STORE LOOSE GEAR								
7	O	DE-ARM & REMOVE CADS								
7	E	JOINT SYSTEMS CHECKOUT								
7	S	JOINT INVENTORY OF AIRCRAFT								
7	T	TOW ACFT TO PRESERVATION AREA								
7	P	PURGE FUEL & PRESERVE ACFT								
7	A	TOW ACFT TO WASH AREA								
7	C	WASH AIRCRAFT								
7	P	PRESERVE CONNECTORS, POST WASH								
7	T	TOW ACFT TO REPAIR HANGAR								
7	A	INVENTORY AND PREP								
7	G	EM RMV BOTTLES, WAVEGUIDE PRESS								
7	G	O LEVEL TO INVENTORY INSPECTION								
7	G	PRESERVE AND STORE EQUIPMENT								
1	Q	QUALITY ASSURANCE								
1	F	AE DISASSEMBLY								
1	G	EM DISASSEMBLY								
1	A	ACM DISASSEMBLY								
1	B	SMM DISASSEMBLY AND ASSIST								
1	N	NON-DESTRUCTIVE TEST AND INSPECT								
1	S	E&E INSPECT								
1	M	MACHINIST INSPECTION AND REWORK								
1	L	FIBERGLASS REWORK								
1	C	CLEANING REWORK								
1	F	AE REWORK-I								
1	A	ACM REWORK-I								
1	G	EM REWORK-I								
1	B	SMM REWORK-I								
1	F	AE REWORK-II								
1	A	ACM REWORK-II								
1	G	EM REWORK-II								
1	B	SMM REWORK-II								
1	K	PAINT AND TOUCH-UP								
1	F	AE REASSEMBLY								
1	A	ACM REASSEMBLY								
1	G	EM REASSEMBLY								
1	B	SMM REASSEMBLY								
2	Q	QUALITY ASSURANCE								
2	F	AE DISASSEMBLY								
2	G	EM DISASSEMBLY								
2	A	ACM DISASSEMBLY								
2	B	SMM DISASSEMBLY AND ASSIST								
2	N	NON-DESTRUCTIVE TEST AND INSPECT								
2	S	E&E INSPECT								

2	M	MACHINIST INSPECTION AND REWORK								
2	L	FIBERGLASS REWORK								
2	C	CLEANING REWORK								
2	F	AE REWORK-I								
2	A	ACM REWORK-I								
2	G	EM REWORK-I								
2	B	SMM REWORK-I								
2	F	AE REWORK-II								
2	A	ACM REWORK-II								
2	G	EM REWORK-II								
2	B	SMM REWORK-II								
2	K	PAINT AND TOUCH-UP								
2	F	AE REASSEMBLY								
2	A	ACM REASSEMBLY								
2	G	EM REASSEMBLY								
2	B	SMM REASSEMBLY								
3	Q	QUALITY ASSURANCE								
3	F	AE DISASSEMBLY								
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6	F	AE REASSEMBLY								
6	A	ACM REASSEMBLY								
6	G	EM REASSEMBLY								
6	B	SMM REASSEMBLY								
		MISC								
7	F	AE BENCH WORK								
7	A	ACM BENCH WORK								
7	G	EM BENCH WORK								
7	G	EM REFLECTROMETRY CHECKS								
7	F	AE REWORK-FINAL								
7	G	EM REWORK-EXTERIOR FINAL								
7	A	ACM INTERIOR FINAL								

7	A	ACM REWORK ROTOR BRAKE AND APU SVC								
7	A	ACM REWORK EXTERIOR FINAL								
7	F	AE REWORK ENVIR SYS CHECKS								
7	F	AE REWORK UTIL SYS CHECKS								
7	A	TAIL DRIVE SHAFT ALIGNMENT								
7	A	INSTALL FWD BRIDGE SUPPORT, BELLCRANK'								
7	A	ACM REWORK FLIGHT CONTROLS								
7	B	SMM REWORK MISC SUPPORT								
		POST REWORK								
7	A	DEPRESV ENG/FUEL SYSTEMS								
7	A	INSTALL MAIN ROTOR BLADES								
7	A	PRESSURE CHECK FUEL SYSTEM								
7	F	AE POWER CHECKS								
7	F	AE FUEL QTY CHECKS								
7	K	MISC PAINT TOUCH UP								
7	G	MISSION SYSTEMS BASELINE CHECK (OUT)								
7	A	FUEL AIRCRAFT, PRESSURE								
7	A	TAKE HYDRAULIC SAMPLES								
7	G	REINSTALL /REPL INVENTORIED EQUIP.								
7	A	WASH								
7	C	CLEAN & POLISH WINDSHIELDS & WINDOWS								
7	S	PERFORM FINAL INVENTORY								
7	A	PERFORM 30 HOUR INSPECTION								
		OP CHECKS								
7	A	OP CHECK HYDRAULIC POWER								
7	A	ASSIST AE WITH BLADEFOLD SYS CHECK								
7	F	AE OPCHECK BLADEFOLD SYS								
7	F	AE OPCHECK XMSN CHIP DETR SYS								
7	F	AE OPCHECK ENGINE CHIP DETR SYS								
7	F	AE OPCHECK AFCS SYS								
7	F	OPCHECK STABILATOR SYS								
7	F	OP CHECK RAST SYS								
7	F	OP CHECK INTERNAL LIGHTING								
		GROUND CHECKS								
7	F	AE GROUND CHECKS								
7	G	EM GROUND CHECKS								
7	F	COMPASS SWING								
7	T	TOW ACFT TO GROUND TEST AREA								
7	A	PERFORM ENG FIRST RUN								
7	S	TAKE HYD SAMPLES, (POST RUN-UP)								
7	A	BLADE TRACK & VIB ANALYSIS								
7	A	PERFORM TORQUE STABILIZATION CIRCLE								
7	L	TOUCH-UP PAINT AS REQD.								
7	A	SERVICE ALL SYSTEMS PRIOR TO DELIVERY								
7	G	MISSION AVIONICS CHECKS								
7	D	ACCEPTANCE/DELIVERY								
7	A	SERVICE ALL SYSTEMS PRIOR TO FLIGHT								
				TOTAL WS	**GRAND TOTAL ACTUAL HOURS**	**TOTAL O-LEVEL HOURS**	**TOTAL CHERRY POINT HOURS**	**TOTAL CCAD HOURS**	**TOTAL SIKORSKY HOURS**	**TOTAL LOCKHEED MARTIN HOURS**

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